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A Manual of Bee Husbandry

by Elmer G. Carr.

Trenton, N. J., June, 1922

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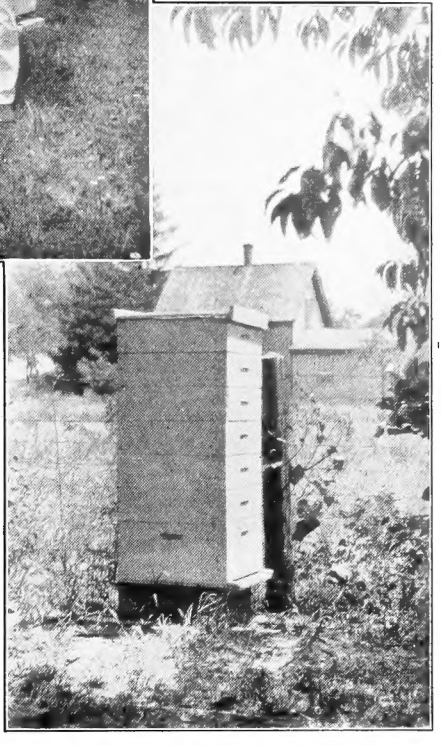
Two hundred and fifty pounds of extracted honey were secured in one season from the New Jersey colony shown at the left.



Two hundred sections of comb honey were taken, in one season, from the New Jersey colony of bees shown at the right.

A Manual of Bee Husbandry

By Elmer G. Carr, *Deputy Bee Inspector*

INTRODUCTION

In 1915 the writer, in "A Manual of Bee Husbandry," attempted to set forth some of the principles of profitable bee management. Many persons have found this publication helpful, and the edition has been exhausted.

Interest in better beekeeping in New Jersey has immensely increased, and requests for information on the subject continue to be received. For these reasons it has been considered wise to rewrite the Manual and embody in it the information gleaned in the past five years in bee disease control and honey production, both from the writer's experience and from the experience of others.

In beekeeping, as in some other vocations, it is a human trait to look to some distant field as the one where the greatest success might be achieved. Undoubtedly this results in many cases in the beekeeper giving his bees less attention than is necessary for good results, under the impression that in some places bees require little or no care.

At the outset it should be borne in mind clearly that, although bees do not need constant attention, if a reasonable amount of success is to be had their needs must be anticipated and adequately met.

The record in New Jersey of 400 pounds of extracted honey from one colony, and another record of 1500 sections of comb honey from five colonies of bees in one season, are sufficient to show that there is good honey-producing territory in New Jersey. (See Frontispiece). Good stock, a good location and good management are needed to produce such results.

These data are not shown to give the idea that such yields are common, but they do show that heavy yields under favorable conditions are possible in New Jersey. The data gained in the work of bee inspection and the inquiries of beekeepers received by mail clearly indicate that beekeepers of this state need a clear presentation of the principles of good beekeeping as they apply to New Jersey conditions.

Honey bees cannot be classed as domesticated in the sense in which that word is used in relation to other farm animals. It is

quite possible that they carry on their activities in practically the same way as they did thousands of years ago. It is true that bees may be induced to live in man-made hives, but these must conform quite generally to the bee's instincts, or the bees will perish.

As man has gained knowledge of the bees' normal activities and adapted them to his use, in just that proportion has he been able to derive profit from the bees.

Since, then, profitable beekeeping is based upon turning to man's account the natural activities of the bees, the first part of this work will be devoted to a discussion of the bees when uninterfered with by man. In the latter half will be discussed methods of directing the activities of the bees so that they may prosper and produce a profit for their owner. (Fig. 1).

Fig. 1. The annual returns from this New Jersey apiary are entirely satisfactory.

LIFE HISTORY

A knowledge of the activities of a normal colony of bees, both collectively and individually, is necessary for its profitable management. A hive occupied by bees is called a colony.

A normal colony of bees consists of a series of parallel combs of wax with nearly hexagonal cells extending in opposite directions from a common base. These cells are slightly elevated at the mouth. The combs are suspended from above, spaced approximately 1 3/8 inches from center to center and stocked with honey, pollen and in the breeding season with immature bees in all stages of their growth.

On these combs are clustered adult worker bees (undeveloped females) to the number of from 3,000 to sometimes 100,000 individuals, depending upon the prosperity of the colony; one fertile queen (fully developed female) and, in the season when mating is possible, a few hundred drones (males); all housed in some place protected from the weather. Honey bees cannot exist except as colonies. When the number of individuals in a colony becomes small they perish.

The different classes of occupants of the hive will be discussed separately.

QUEEN

The queen (Fig. 2) is a fully developed female whose only duty is the production of eggs. She is reared in an especially constructed cell which normally points downward and is usually built singly, although queen cells are sometimes found in groups of two or three. The internal diameter of the queen cell is about one-third of an inch. In its early stages of construction it resembles an acorn cup, and when completed the outside is indented, somewhat resembling a peanut shell. In this cell a female egg is deposited from which, at the end of

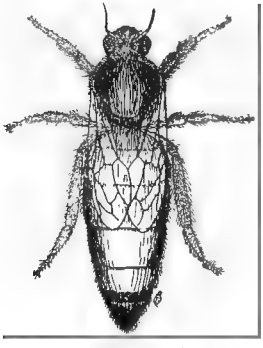


Fig. 2. Queen—Redrawn ABC.

three days, emerges a minute grub so small as to be almost invisible to the unaided eye. The grub is then surrounded by and floats in a creamy mass called royal jelly, a mixture of honey and pollen which has undergone a process by the nurse bees who supply it to the developing larva. On this the larva feeds and increases in size until at the end of the fifth day of its existence, or eight days from the deposition of the egg, the grub (larva) entirely fills the cell which has been elongated as the larva grew until it is upwards of an inch in length. At this time it is sealed over by the worker bees.

In the next stage of development, known as the pupal period, the creature undergoes transformations and is changed into a winged insect. It also lines its cell with a cocoon which does not extend to that third of the cell nearest the base. About eight days after sealing the adult winged queen removes the cap from the point of the cell and emerges from the cell. Usually about one day previous to the emergence of the queen the bees remove the waxen point from the cell leaving only the fibrous cocoon confining the queen. The queen is equipped with a sting which is slightly curved, is not barbed, and is seldom, if ever, used except against a rival queen.

Appearance

The shape of the queen reminds one of a wasp or hornet. As compared with the worker her abdomen is longer and more pointed at the posterior end. Because of the length of the abdomen the wings appear shorter than those of the worker bees, but in reality they are slightly longer. The color of the queen varies, with the race or admixture of races, from a light brown to a glossy black or a combination of the two, and varies most on the abdomen.

Soon after emergence from the cell the queen goes to an open cell of honey and satisfies her need for food. When from five to eight days old she leaves the hive for the mating flight which occurs in the open air. After a successful mating the queen returns to the hive bearing evidence of union with the drone by the drone's genital organ still attached to her body. At the time of copulation the queen receives a supply of spermatozoa which is stored in a receptacle (spermatheca) within her body. The spermatozoa remain active during the lifetime of the queen, which may be four or five years or until the supply becomes exhausted. About two days after mating the queen commences to deposit eggs, which she places in the cells to the bottom of which they are attached at one end. These eggs are pearly white in color and about one-sixteenth of an inch in length. Their short diameter is about that of the period used in this printing. Under favorable conditions a queen will deposit upwards of two thousand eggs in a day and continue at this rate for weeks. She deposits eggs which will bring forth males, these eggs being called fertile but unfertilized. Eggs which will result in females are also deposited; these are said to be both fertile and fertilized. No spermatozoa are found in the male eggs.

After a successful mating flight, only one of which occurs during the lifetime of the queen, she does not again leave the hive except to accompany a swarm.

A queen which does not become fertilized before she is many weeks old seldom, if ever, proves to be of any value. There are re-

ports of queens reared in the fall having mated the following spring, but positive evidence on this point is lacking.

Any female larva less than two days old may become a worker or queen, depending upon the manner in which it is reared. If the larva is in a cell one-third of an inch in diameter and is fed on "royal jelly" for the full feeding period, the result will be a fully developed female—queen. If by accident or otherwise a colony becomes deprived of its queen and still has female larvae less than two days old it is possible for the bees to produce a queen from a female larva by enlarging the cell and giving the royal food for the full feeding period. In this manner the loss of a queen may be corrected if there are still female larvae young enough. But if the larvae are older than two days a queen cannot be developed and the colony is said to be hopelessly queenless.

A queen will deposit more eggs the first year than in any subsequent year of her lifetime.

Abnormal Queens

Beside the normal queen just discussed there are the following abnormal ones: (1) Those which deposit eggs irregularly (poor layers); (2) those whose eggs produce drones only (drone layers); (3) those whose eggs do not hatch, and (4) queens which do not deposit eggs. The work of the poor layer is distinguished by the combs of capped brood having scattered through them cells vacant or containing young uncapped larvae instead of solid spaces of brood of uniform age. If, from any cause, a queen is not able to take the mating flight before she becomes some weeks old, she can and usually will produce eggs which will hatch. These eggs, however, because of the absence of spermatozoa in them, will give rise to drones only. Such a queen is known as a drone layer. The work of a drone layer may be recognized by drone brood in worker comb, indicated by the very convex cappings over the cells plus the eggs regularly placed in the bottom of the cells.

Occasionally there is found a queen depositing unfertile eggs. This is rather uncommon, and more so is the case of a queen which does not deposit eggs at all, although these abnormal queens are sometimes seen.

There is but one normal laying queen in a hive except in case of supersedure, when both mother and daughter may, for a time, produce eggs in the same hive, Soon, however, the old queen disappears.

Workers

The workers (Fig. 3) are undeveloped females and do not produce eggs except under abnormal conditions.

Workers are reared in cells which are by far the most numerous in the colony and measure one-fifth of an inch in diameter. They are hatched from female eggs. The incubation period is three days. The worker larvae are fed on a prepared food which, during the first two days, resembles that given the queen (royal jelly) except that the quantity is much less. After the first two days the food is less finely prepared and becomes coarser, until at the end of six days feeding ceases. During this period the larva has increased in size until it completely fills the cell. It is then capped over by the workers.

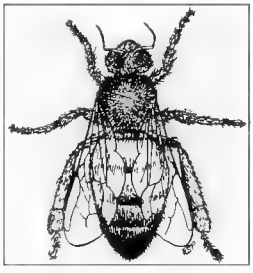


Fig. 3. Worker—Redrawn ABC.

During the next twelve days it undergoes transformations, and at the end of this period, which is twenty-one days from the time the egg was deposited, bites its way from the cell a fully developed winged insect.

Appearance

The worker bee differs from the queen in appearance principally in the size and shape of the abdomen. There is also a difference in the size and shape of the thorax and head. The abdomen of the worker bee is considerably shorter than that of the queen and comes to a point more abruptly. It is also smaller in diameter, particularly as compared with a laying queen whose abdomen is distended with eggs. After emerging from the cell it soon takes up the inside work of the hive, such as feeding larvae, secreting wax and building comb, ventilating, and keeping the hive free of refuse matter. These young workers are called nurse bees. About midday on bright sunshiny days the young workers fly from the hive and mark its location and void the feces. The first flight is a very short distance from the hive. These flights increase in length until the bee has fixed the location of the hive and can unerringly return to its home. These flights are called "play flights," and because frequently a large number of bees engage in it at one time it is sometimes mistaken for an attempt at swarming. When about two weeks of age the workers take up outside work and

collect and bring to the colony nectar, pollen, water and propolis or "bee glue."

Workers are furnished with eight glands, called "wax pockets," on the underside of the abdomen arranged four on each side. These secrete wax which is removed from them by the bee herself. At the time of removal these wax flakes are about the diameter of the head of a pin, tend to a circular form and are of milky whiteness in color. These the workers fashion into comb by a kneading process with the mandibles.

The adults under fourteen days old are the ones which secrete wax most readily. Older adults do little or nothing in this line, as the organs which produce wax fail to function readily.

The number of workers in a colony may vary greatly and may be a few hundred or many thousands. The lifetime of a worker bee under active working conditions is about six weeks, but one hatched late in the season may live until the following spring, and is old or young as she has worked much or little. The worker bee is furnished with a sting which is straight and barbed. This she freely uses in defence of the colony.

The shaft of a worker's sting is composed of three parts, the two-barbed parts of which are held together by a third semi-sheath along which the barbs alternately glide as they are driven into the flesh by the controlling muscles. Connected with this is the poison sack about the size of a cabbage seed, from which the poison is forced into the wound through a canal formed by the union of the two barbs and the sheath. As the sting is driven into the flesh the poison is injected into the wound until the sting is driven in its entire length and the poison sack entirely emptied. Because of the barbs the sting cannot easily be withdrawn when inserted in the flesh. It is seldom removed by the bee, but by her efforts she separates herself from the animal attacked by forcibly separating the sting from her body, leaving attached to the sting the poison sack, the muscles which control them and a part of the intestine. This constitutes a rather serious injury to the bee and results in her death, although a bee so injured has been known to live two or three days.

Abnormal Workers

When a colony becomes queenless and has no worker brood young enough to develop into a queen, often a worker or workers will produce eggs. Since the worker cannot mate with the drone these eggs produce drones only, being unfertilized. These eggs are not placed in the normal position in the bottom of the cell but are found largely on the side walls. Another indication of laying workers is drone brood in worker cells characterized by the very convex capping on

worker cells. This condition of the cappings is also present in the case of a "drone laying" queen, but the eggs for the most part are normally placed in the bottom of the cell.

Drone

The drone (Fig. 4) is the male bee and, so far as is known, serves no useful purpose except to fertilize the queen.

He is reared in a cell shaped like the worker cell but larger and measures one fourth of an inch in diameter. He is hatched from an unfertilized egg in three days from the time it is deposited in the cell.

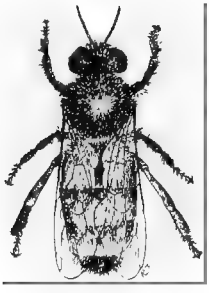


Fig. 4. Drone—Redrawn ABC.

The tiny grub is then fed in a manner similar to the workers, is sealed over at the end of the feeding period (seven days) and fourteen days later, or twenty-four days from the time the egg was deposited, comes forth from the cell fully developed. It is believed a drone is not capable of fertilizing a queen until about two weeks old. Drones are present in a normal colony only during that season of the year when queen mating normally occurs; hence, there are no drones in a normal colony in winter. Drones fly from the hive for exercise and to void the feces. They are not capable of gathering their own food, but feed upon the stores within the hive. After the season has passed when queen mating is possible, or at a time when there is a severe dearth of nectar, the drones are driven from the hive by the workers and perish from cold and hunger. Their lifetime, therefore, may vary from a few days to a few months.

Appearance

In appearance, as compared with other members of the colony, the drone is a massive fellow. His whole body is larger and has the appearance of being cumbersome. The most marked difference is in the abdomen, which is larger in every way and very blunt at the posterior end. He has no sting.

There may be abnormal drones, but there are always so many more drones reared than can fulfill their mission that no fear need be felt that an insufficient supply of normal drones will occur. But one drone is needed to fertilize each queen, in which act he loses his life.

Table showing the approximate time of development of honey bees in different stages of existence.

	Eggs	Feeding period Larva	Transformation period—Pupa	Total	Adult Period
Queen	3 days	5 days	8 days	16 days	3-4 years
Worker	3 days	6 days	12 days	21 days	6 weeks in active season
Drone	3 days	7 days	14 days	24 days	uncertain, 2 wks.-2 mos.

Note:—Half-days are sometimes used in indicating the periods of development except for the egg.

It is entirely possible that because of the food supply or temperature, the development may be accelerated or retarded. However, for the practical beekeeper the figures given will prove reliable.

BROOD

During eight or nine months of the year in New Jersey, there are found in the combs of a normal colony young bees in all stages of development, from the newly deposited egg to the winged insect emerging from the cell. This is known as the brood and is called sealed or open brood, depending on whether or not the cell is capped.

EGGS

So far as outward appearance goes there is nothing to distinguish an egg which will produce a male from one which will bring forth a female. One can be assured, however, that an egg which has been deposited in a drone cell will bring forth a male and one in a queen cell may be depended upon to develop into a queen. Very rarely worker brood may be found in drone cells.

When deposited in a worker or drone cell an egg projects in a horizontal position from the center of the base of the cell. As hatching time approaches it leans over and rests for its full length on the cell base.

The normal color of uncapped brood (larvae), whether drone or worker, is a bluish white. When not so colored it is probably diseased. This will be discussed later.

The capping of brood has a porous appearance, and in reality it is sufficiently porous to admit the amount of air required by the

developing creature beneath. The capping over normal brood is slightly convex. Over drone brood the convexity is pronounced, and its appearance has been likened to that of pistol bullets standing upright close together.

When cappings become sunken or perforated very likely disease is present.

CYCLE OF THE YEAR

There is a season of the year when no brood-rearing is being carried on within the hive. This in New Jersey commonly begins about November 1, although a colony headed by a young vigorous queen may have brood later than this date.

At the approach of the inactive season brood-rearing gradually diminishes until it finally entirely ceases. If the nectar supply will permit, after the young bees emerge the cells are stored with honey and capped with a waxen lid.

Seldom, if ever, are all the cells filled with honey, but when the nectar supply fails there are still cells containing developing brood. When this brood emerges there is an area of unfilled cells in and around which the bees cluster when the temperature within the hive is 57 degrees F. or less. When the temperature within the hive is less than that named the bees, by muscular activity, generate heat and keep the temperature within the cluster of a normal broodless colony of bees up to this point.

The bees feed on the stored honey to supply their needs. When the weather, because of low temperature or storm, is such that they are confined to the hive for some weeks, there is an accumulation of waste (fecal) matter within their bodies. This is normally discharged only when on the wing.

When the coldest period of the year occurs a normal colony of bees, when not abundantly protected from low temperatures, greatly increases its activity, and the cluster temperature is raised to a point where egg deposition begins. This in New Jersey occurs sometime about the tenth of February, varying perhaps ten days between the extreme northern and southern parts of the state, and also varying with the outdoor temperature.

But a few eggs are deposited in one comb at this early period. The rate of egg-laying increases as the season advances until the queen reaches her maximum production sometime about May 15 to June 1.

THE SWARM

The numerical force of the colony is gradually reduced by deaths through the non-broodrearing period. Gradually in spring through

the stimulus of increased temperature and incoming food, the numerical strength is increased by the daily emergence of young bees in excess of the death rate, until plans are made by the bees for the departure of the queen and a number of the bees to build a home elsewhere. This is called swarming. (Fig. 5).

Fig. 5. A large New Jersey swarm (original).

In anticipation of this event, drones have been reared and later queen cells appear. The rearing of drones is not usually considered by practical beekeepers as a sign of swarm preparations, but the building of queen cells, except supersedure cells, is taken as a dependable swarm preparation sign. Rarely colonies under certain conditions will abandon swarm preparation even after having started swarm queen cells. The queen cells are not all started at one time, but their ages will vary several days. When the oldest of these cells is sealed, the swarm departs on the first favorable day. With the first or primary swarm goes the old queen, a considerable number of drones and thousands of workers of flying age.

Just previous to the departure the workers fill themselves to their fullest capacity with honey. Thus they are equipped for the work of establishing a new home, and are provisioned against hunger should there immediately follow a few days when no food-collecting is possible. Usually swarms alight and remain clustered on some support for a varying length of time before occupying their new home. There is evidence that certain worker bees called scouts frequently and possibly usually select the new home and direct the swarm to it after they have been clustered for a time. Swarms have been known to remain on the limb of a tree where first they clustered, there build their nest and remain until they perished from the winter storms.

Primary swarms usually alight comparatively low and not far from the hive, but after-swarms are not so considerate of the beekeeper's wishes and often alight high and at some distance from the hive.

Eventually the clustered bees normally break cluster and fly to the home selected. In this they cluster again in a compact mass. The younger workers within a short time secrete wax, and the work of building the combs of the new home begins. A part of the field force goes out, collects and brings to the hive pollen, water and nectar, and as soon as cells are prepared the queen commences egg deposition. The size of the nest enlarges as the number of bees and the season will permit, and in due time the colony becomes fully established. Honey and pollen are collected and stored. As autumn comes on preparation is made for winter, and brood-rearing ceases.

THE PARENT COLONY

When the swarm departed from the hive it left behind combs stocked with honey, pollen and brood of all ages. There were also queen cells in different stages of development, some of which were sealed, and the worker force which was afield at the time the swarm issued.

If the primary swarm was not delayed by unfavorable weather conditions, a second swarm is due to issue about the ninth day after the primary swarm came forth. This second swarm, and any subsequent after-swarms, is accompanied by an unmated queen (virgin). The behavior of after-swarms is similar to that of primary swarms except that they usually alight higher and farther from the hive. A prosperous colony in a favorable season may cast three swarms. The third issues about four days after the second. When the last after-swarm is cast all the emerged queens go with it except one. A swarm may thus have several queens (virgins) with it. It is supposed

the surplus are killed in the battle which occurs between the queens when more than one normal queen is at liberty in a colony.

When the bees determine that no more swarms shall issue, the emerged queens, except one, go with the last swarm, and the immature queens, if any, are destroyed in their cells. Such destruction is indicated by an opening in the side of the queen cell, whereas when the queen emerges normally the opening is at the point.

The queen which is left alive in the parent colony fares forth, mates, returns and carries on the work of egg production there. Brood-rearing and food-collecting are carried on so long as weather conditions permit, excepting that as autumn approaches brood-rearing is reduced until a time arrives when it ceases entirely. The cells which have been vacated by the emerging bees late in the season are filled with honey to supply the needs of the colony during the time when collecting is not possible.

This briefly is the story of the activities of a normal colony during the year. Without a knowledge of these activities and how to direct them the beekeper has small chance for satisfactory profits from bees.

ABNORMAL COLONIES

Beside the normal colonies discussed there are abnormal ones.

Queenless Colonies

A colony which has a normal laying queen is said to be "queen-right." When no queen is present it is termed "queenless." Queenlessness may be the result of accident or disease. When the virgin goes forth for the mating flight she may be caught by a bird and her colony becomes queenless, because at this time there is no brood in the hive young enough to be made into a queen; she may mistake her hive when returning from the mating flight, enter the wrong hive and be killed, or she may be killed by careless handling of frames by the beekeeper. This latter rarely occurs. The developing queen in the cell may die of disease and the colony thus become queenless. This will be discussed under the head of disease.

Signs of Queenlessness

During the normal brood-rearing season eggs are present in the combs if the colony has a laying queen. The presence of eggs then indicates the presence of a laying queen, except in the case of laying workers as discussed under the head of "workers." There is one period when there may be a normal queen in the colony and no eggs be present. This is during the period three days after the

primary swarm issued until the young queen commences to deposit eggs. This condition will be indicated by the presence of brood, sealed and unsealed, and the absence of unsealed queen cells.

REPLACING A LOST QUEEN

A female larva under three days of age may become a queen or a worker, depending upon the care and environment given. If fed abundantly on the finely prepared food for its entire larval existence (five days) and given a cell of sufficient size, it will be a fully developed female (queen). If fed on a less finely prepared food and confined to the smaller size cell (worker cell) it will be a worker.

Within a few hours after a colony loses its queen, the bees take steps to repair the damage. This is done by enlarging the cell around one or more sufficiently young worker larvae less than three days old, if such are in the hive, and feeding them abundantly. These are called "post constructed" cells or emergency cells. Since these are built over already hatched larvae, they are more frequently found on the side of a comb than on its edge. By using a two-day larva rather than a fresh egg, a queen is had in the colony about five days earlier.

Except in treating European foulbrood it is considered inadvisable to have a colony without egg production during the active season for a longer period than is unavoidable.

Soon after the emergence of a queen from her cell in a normal colony, the cell is torn down leaving only the base.

FOOD SUPPLY

It is not practicable to confine honey bees and supply them with food as is done with many domestic animals, but they gather food from plants which may be bearing pollen and nectar in the vicinity. How far a bee will fly for food is not definitely known. Neither is it known if it is unprofitable for bees to collect from plants which are at the bounds of their range of flight. It is the opinion of many beekeepers that profitable range of flight is not greater than two miles. In order that the largest crops of honey be secured, the beekeeper needs to have at least a general knowledge of the pollen and nectar resources of his locality. Other factors being equal, the beekeeper who succeeds in having his colonies reach maximum strength when the surplus honey plants begin to secrete nectar and is able to keep them contentedly working through this period is the one who will secure the largest yields.

Some plants have no value to the beekeeper so far as food for

bees is concerned; some have value as producers of pollen for brood-rearing; some produce considerable nectar, but not in quantities beyond that which the bees need for their own use, while some plants produce nectar in such quantities that the bees are able to collect and store many pounds more than they need.

No claim for absolute correctness is made for the list here given of pollen- and nectar-producing plants of value to honey bees. It is hoped it will serve as a basis for further observations by the beekeeper.

NEW JERSEY PLANTS FROM WHICH BEES GATHER POLLEN

Common Name	*Botanical Name*	*Approximate Blooming Time*
Skunk Cabbage	Spathyema foetida, L.	February-March
Shad bush	Amelanchier intermedia Spach.	April
Maples	Acer, Spp. L.	March-Mid April
Hazel	Carylus americana, Wilt.	Late March-Early April
Elms	Ulmus, L.	Late March-Early April
Willows	Salix, L.	Late April
Dogwood	Cornus florida, L.	May
Dandelion	T. taraxacum; L.	May
Ash	Fraxinus	May 1-15
Horse Chestnut	Aesculus hippocastanum L.	May-June
Birch	Betula	May 15-30
Hickory	Hicoria	May
Oaks	Quercus	May
Locust	Robina pseudacacia, L.	Late May-Early June
Crimson Clover	Trifolium incarnatum, L.	May
Tulip Whitewood	Liriodendron tulipifera, L.	Late May-Early June
Wild Cherry	Prunus serotina, Ehrh.	Mid May-Early June
Mountain laurel	Kalmia latifolia, L.	June
Sheep laurel	Kalmia angustifolia, L.	June
Black alder	Ilex verticillata, L.	Mid June-Late June
Ox Eye daisy	Chrysanthemum leucanthemum, L.	Mid June
Indian corn	Zea Mays	July-August
Cucumber	Cucumis salivus, L.	August
Melons	Citrullus, K.	August
Sunflower	Helianthus	Mid Aug.-Mid Sept.
Wild turnip	Brassica campestris, L	August
Ragweed	Ambrosia, L.	August
Touch-me-not	Impatiens biflora. Walt.	August-September
White aster Heath aster St. Michaelmas daisy	Aster ericoides, L.	August-Mid October
Goldenrod	Solidago Spp. Britton	Late Aug.-Early Oct.

NEW JERSEY PLANTS FROM WHICH NECTAR IS GATHERED IN LESS THAN SURPLUS QUANTITIES

Common Name	*Botanical Name*	*Approximate Blooming Time*
Maples	Acer Spp. L.	Mid March-Early April
Peach	Amygadalus persica, L	Early April
Pear	Pyrus communix, L.	Mid April
Apple	Pyrus malus, L.	Late April-Early May
Willows	Salix	Late April
Dandelion	T. taraxacum, L.	Early May
Wild Strawberry	Fragaria virginiana, Mill.	May
Lupine	Lupinus perennis, L.	May
Raspberry	Rubus occidentalis, L	May
Grape	Vitis	Late May-Early June
Persimmon	Diospyros virginiana, L.	Mid June-Late June
Vervain	Verbena hastata, L.	Late June-Early Sept.
Virginia creeper	Ampelopsis quinquefolia, Michx.	Late June-Late July
Milkweed Silkweed	Asclepias syriaca, L.	July
False indigo	Baptisia tinctoria, L.	July
Button bush	Cephalanthus occidentalis, L.	July
Burdock	Arctium minus, Schk.	July-October
Tree of Heaven Pride of China tree	Ailanthus glandulosis, Desf.	July
Catnip	Nepeta cataria. L.	July
Motherwort	Leonurus cardiaca, L.	August
Horsemint	Monarda punctata, L.	August-September
Boneset	Eupatorium perfoliatum, L.	Mid August-September
Poison ivy	Rhus radicans, L.	Mid May-Late June
Holly	Illex opaca, Ait.	Late May-Late June
Mountain laurel	Kalmia latifolia, L.	Late May-Late June
Sheep laurel	Kalmia angustifolia, L.	Late May-Late June
Burdock	Arctium minus, Schk.	July-November

NEW JERSEY SURPLUS HONEY PLANTS

Common Name	*Botanical Name*	*Approximate Blooming Time*
Crimson clover	Trifolium incarnatum, L.	Mid May
Locust	Robina pseudacacia, L.	May 20-June 1
Tulip tree	Liriodendron tulipifera, L.	May 20-June 10
Swedish clover Alsike clover	Trifolium hybridum	June 1-July 10
White clover	Trifolium repens, L.	Early June-Mid July
Dogbane Indian hemp	Apocynum cannabium, L.	Early June-Late Aug.
Basswood Linden	Tilia americana	Late June-Early July
Huckleberry Blueberry	Vaccinium, Spp. L.	Late May-Late June
California privet	Ligustrum ovifolium	Mid July-Late July
Sumac	Rhus Spp. L.	Mid June-Mid July

White sweet clover	Melilotus alba. Desr.	June-November
Yellow sweet clover	Melilotus officinalis	May 20-June 15
Cranberry	Oxycoccus macrocarpus, Ait.	June 15-August 15
August flower, Soap bush, Sweet pepper bush	Clethra alnifolia, L.	Late July-Late August
Rose mallow, Swamp mallow	Hibiscus moscheutos, L.	Late July-Early Sept.
Spanish needle	Bidens. L. Spp.	Mid August into Oct.
Heartease, Smartweed, Blackheart	Polygonum Pennsylvanicum, L.	Late August-Mid Oct.
Heath aster, White aster, St. Michaelmas daisy	Aster ericoides	Late August-Mid Oct.
Goldenrod	Solidago spp. Britton	Late August-Mid Oct.
Buckwheat	Fagopyrum esculentum	Early August-Late Aug.

Surplus Honey Regions

We may divide the State of New Jersey into three zones on the basis of surplus honey production. (Fig. 6).

The first zone includes all of the southern and middle counties and the southern part of Middlesex, Somerset and Hunterdon. As a rule the surplus honey in this district comes from clover. There are occasional places, such as lowlands along large streams, where a second flow is harvested in late summer and early autumn.

The second zone includes all north of the first with the exception of Hudson County and a part of Bergen, Passaic, Essex and Union. In this district there are generally two distinct heavy honey flows: the first from clover, and the last from buckwheat and fall flowers, such as goldenrod, aster, etc.

The third zone, which roughly includes the Passaic and Hackensack Valleys and the Raritan Valley below New Brunswick, usually produces no surplus honey except in the fall. This fall surplus is gathered from goldenrod, aster, heartease, and mallows.

The zone map is general and must not be taken as specific. Instances could be cited where a distance of three miles made the difference between a good surplus honey flow and no flow. There are districts within these zones which differ considerably from the general conditions of honey flow in the zone. To illustrate, there is a narrow area along the Delaware River from Burlington to Camden where no surplus from clover can be expected, but the Spanish Needles (Bidens spp.) furnish a fairly dependable fall surplus flow. Again there are areas in Hunterdon, Warren and Morris counties where an abundance of Sumac furnishes a splendid surplus honey flow in July. There are also limited areas in Hunterdon, Somerset,

Morris and Warren counties where sweet clover is an important surplus honey plant. Therefore each beekeeper is urged to collect data for his own locality.

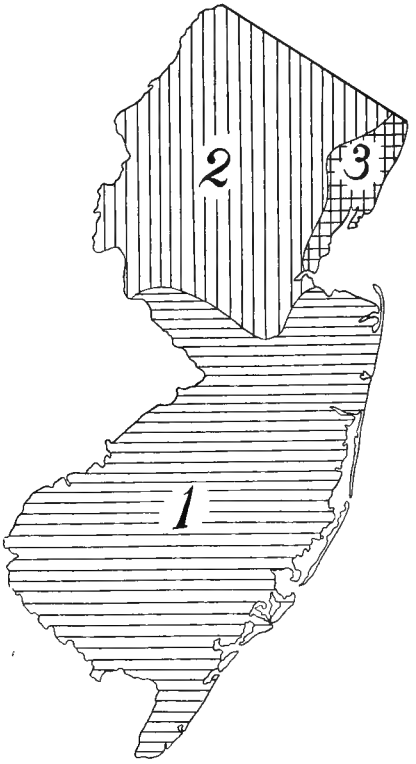


Fig. 6. Zone map (original).

RACES OF BEES

The world has been searched for honey bees in an effort to secure the race which will give the best results under North American conditions. The German, Italian, Egyptian, Caucasian, Carniolan and Cyprian honey bees have been tested, also crosses of these races. The domestic Italians have gained and still hold a reputation for utility far ahead of other races or strains.

There are strains of Italians, the results of selection and breeding, called three-banded, leather-colored and golden, according to the color. It is probable the difference is principally one of color. The preference at this time is for the leather-colored bees.

A colony is considered to be pure Italian when all of the worker offspring of a queen have a pronounced yellow band on each of

the three anterior segments of the abdomen and the bees are quiet under manipulation. The abdomen of the Italian queen is usually colored a light brown. The drones vary considerably in coloring, some being a light brown while others are a rather dark brown with combinations of these shades.

MAKING A START WITH BEES

There are business concerns which make a business of selling bees and beekeepers' supplies. In many cases it is wise to buy a colony of Italian bees from a reputable firm as early in the spring as is possible, even though the cost is considerable. Another way to make a start is to purchase a colony nearby, if one satisfactory in every way can be had. Still another is to secure a hive fitted up for bees and get some beekeeping neighbor to put into it an early swarm. Buying bees in box hives or old frame hives, and transferring to modern frame hives, gives excellent experience, and when a novice has accomplished this he has gained experience which is valuable and can hardly be secured in any other way. From a financial standpoint it is of doubtful value. Buying bees in packages without combs, or buying two or three frame nuclei, is sometimes practical for the experienced beekeeper, but only by rare chance will the person with limited knowledge of beekeeping avoid loss by this method of starting with bees. For this reason the novice is advised to get a full colony. The experienced person needs no advice in the matter but can apply his knowledge in a way which will give best results.

LOCATING THE COLONY

The majority of New Jersey beekeepers have bees as a side line, and because of limited space have little choice as to where they shall be located. The wise beekeeper will bear in mind that the public is afraid of bees whether there is danger or not. He should further consider that there may be considerable advantage to the bees in one location rather than in another. The colonies should be placed where there will be the smallest danger of annoyance to persons or animals passing or to animals in fields.

The bees will be favored if the hive is protected by some sort of windbreak from the prevailing winter winds. Bees are sometimes kept on the roofs of buildings, and at least one colony in New Jersey is kept in a living room with an entrance through a board under the window. A solid board fence is not a good windbreak, but if a fence is used for this purpose the boards should be spaced a short distance apart. This arrangement checks the currents of air

and does not set up eddy currents which may blow in the hive entrance. It is exceedingly unwise to place the hives close together making it impossible to work at them from the side. The young queens also are more likely to mistake their hive upon returning from a flight, and, entering the wrong hive, be killed.

If conditions make it necessary, the hive may be placed a considerable distance from the ground; otherwise, it is best elevated only enough to preserve the bottom from decay.

The direction the front of the hive shall face appears to have but little bearing on the prosperity of the colony, although when practical a southerly direction is chosen. Dense shade is not considered desirable, neither is it well to place the hive close beside the south side of a building in the full sunlight in summer unless adequate shade is provided.

LOCATING THE APIARY

If the largest financial success is desired, care should be taken to locate the apiary where there is the greatest opportunity for the bees to gather nectar. The "back-lotter" with his dozen or less colonies will, of course, make the best of the location in which he finds himself, but the person who plans to make honey production a worth-

Fig. 7. The annual return from this New Jersey apiary is $7.00 per colony.

while business will be well repaid for the trouble taken to search out the most advantageous location. There are locations where, because of a variety of nectar-secreting plants, there is usually more than one major honey flow, making it less likely that there will be an entire crop failure should any one of the surplus honey plants fail to yield. Such a location the wise business beekeeper will use much care to find. Selecting a place where a natural windbreak, either forest or bluff, will provide protection from the prevailing winter winds may mean the difference between strong colonies or weak and dead ones in the spring. (Fig. 7). A location in a wood is excellent so far as wind protection is concerned.

Accessibility by the vehicle used is essential, as is also security from annoyance to animals or persons. If the beekeeper's residence is beside one of the trunk highways there is then afforded the opportunity to dispose of much of the crop at a roadside stand, and in this way more profit may be secured.

APPARATUS

Successful beekeeping does not require much nor complicated apparatus. As with other agricultural pursuits, there is a change in apparatus as the business develops. It is but a few years since swarms were hived in a plain box with perhaps two cross sticks to help support the combs. To get the honey the bees were killed (taken up) over a pit with sulphur fumes. Later the box was made with an upper and lower compartment. The surplus honey was removed from the upper compartment without killing the bees. This did not permit an examination of the interior of the colony and gave only a limited control of the bees. In 1851 Rev. L. L. Langstroth invented a hive with each comb surrounded by a frame so that each could be removed and replaced at will without damage. This was made to accommodate ten frames, and the hive used by the majority of beekeepers in America today is, so far as capacity and arrangement of frames are concerned, the same as that made by Langstroth.

There is a tendency at this time to use a hive with deeper frames than the Langstroth. While those who advocate this present some strong arguments for its use, more experience seems necessary before definite statements are advisable.

THE HIVE

The modern ten-frame hive, sometimes called the Langstroth hive, is a box with removable top and bottom, (Fig. 8) the top being tight fitting and the bottom so made that there is a space below the level of the bottom of the box. (Fig. 42). This box measures outside 16 1/2

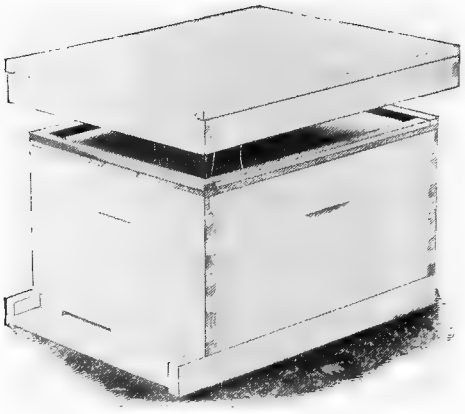


Fig. 8. Modern 10-frame bee hive—Root Co.

X 20 X 9 1/2 inches, and is rabbetted on each end to support ten frames measuring outside 9 1/8 X 17 5/8 in such a manner that there is a space of approximately one-fourth inch between the ends of the frames and the end of the hive, and a like space between the

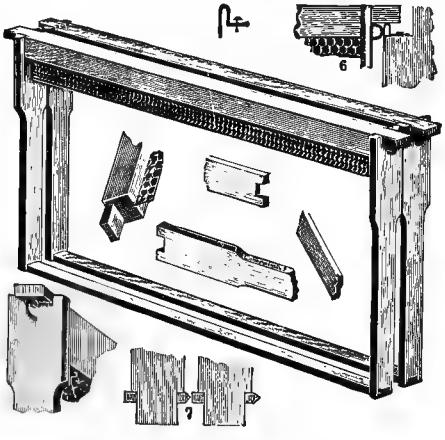


Fig. 9. Brood frames.

top of the frames and the level of the top of the hive. The frame ends touch each other for one-third of the distance from the top and are spaced 1 3/8 inches from center to center (Fig. 9). These frames have the end bars pierced so that four small wires can be strung horizontally through the frame, the first 3/4 inch from the top bar, the bottom 1 1/4 inch from the bottom bar and the other two equally spaced between. These are to support and strengthen

the comb, which is built by the bees from a sheet of embossed beeswax (foundation) that is secured at the top in the groove provided and is fastened to the wires. This is done by pressing the wires into the foundation, or, which is far better, the wires are embedded

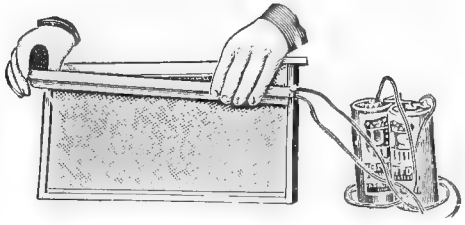


Fig. 10. Electrical wire imbedder (Root).

by an electrical device (Fig. 10) which heats a section of the wire, and by a rocking motion the current is transferred to other sections as each beomes sufficiently heated. This causes the wire to sink into the softened wax. A full sheet of medium brood foundation should be used rather than a narrow strip. It frequently occurs when only a narrow strip of foundation, called a starter, is used in the frames that the bees build much drone size comb. This is most likely to occur if the queen is not a vigorous one. As a rule, so long as the queen produces eggs rapidly enough to use cells for eggs as fast as the bees build them, worker comb will be built; otherwise, the tendency is to build drone or store-size cells. To insure the greatest amount of worker-size cells in the colony, which is desirable, a full sheet of foundation should be used in the frames. This is to reduce the number of drones, since the foundation is embossed with the rudiments of cells of worker size and, with rare exceptions, the bees follow the pattern and build worker comb. It also insures greater regularity of combs.

As sent from the factory the frame end-bars are pierced so that the top wire is three-fourths inch below the top bar. Much better results follow when this wire is but one-fourth inch below the top bar. When so placed and the foundation is electrically imbedded, fastening the foundation in the groove is unnecessary.

That part of the hive which rests on the bottom board and contains the ten frames is known as the brood chamber. In it the bees rear their young and store honey for their use when collecting is not possible. That portion of the combs in the brood chamber occupied by brood is known as the brood-nest. Sometimes a second chamber is used for brood, and it is then a two-story brood chamber. This is becoming a common practice, as it gives a larger space for the activities of the queen, results in a larger force of bees being reared and, as a consequence, a larger crop of surplus honey.

Bees do not consciously gather nectar and convert it into honey for man, but their object is to supply their own needs when gathering is not possible. Man has taken advantage of this providence of the bees, supplies them with room in which to store surplus honey instead of dissipating their energies in swarming, and removes from the hive the amount above that which the bees will need through the non-collecting period.

SUPERS

When an addition is made to the hive in which the bees are expected to store the surplus honey it is known as the super.

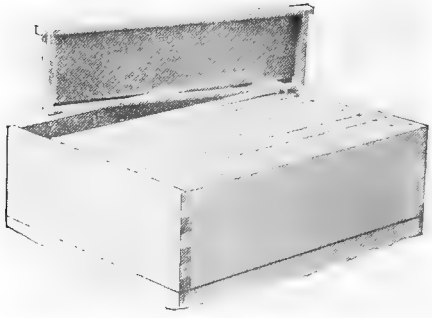


Fig. 11. Shallow extracting super (Root).

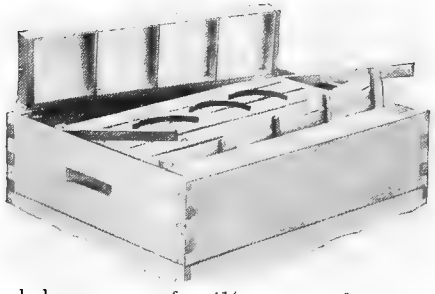


Fig. 12. Comb honey super for 4¼ square, plain sections (Root).

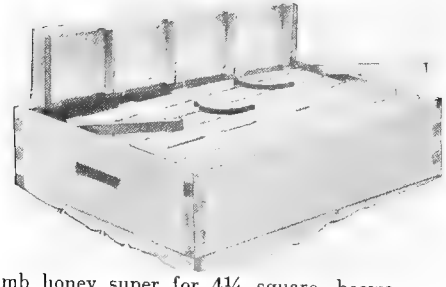


Fig. 13. Comb honey super for 4¼ square, beeway sections (Root).

The construction of the super depends upon whether comb or extracted honey is desired. When extracted honey is produced beekeepers in general use a super with frames the same as the brood body, which provides for the interchange of frames from one to the other. A few beekeepers use what is known as the shallow extracting super (Fig. 11) the frames in which are similar to brood frames but of lighter construction and about one-half the depth.

For the production of honey for market to be used in the comb, a comb honey super (Figs. 12 & 13) is used. This accommodates twenty-four to thirty-two thin basswood frames depending upon the size and style. These frames are called sections. The sections are of such size that when well filled with honey they will weigh approximately one pound. Four of these sections are supported in a three-sided frame (section holder), and each section holder is separated from the one next to it by a "separator" or "fence" depending upon whether it is a thin board or a fence-like affair made of thin slats of wood.

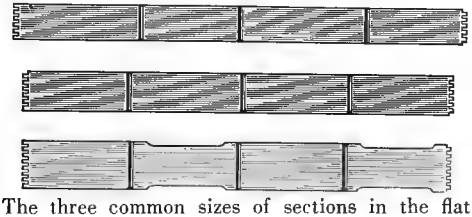


Fig 14 The three common sizes of sections in the flat (Root).

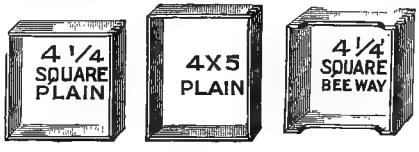


Fig. 15. The three common sizes of sections folded (Root).

In most common use are the two beeway sections measuring 4 1/4 X 4 1/4 X 1 7/8 inches, the plain section measuring 4 1/4 X 4 1/4 X 1 1/2 inches and the 4 X 5 X 1 3/8 plain section. (Figs. 14 & 15). The beeway section has insets in its edges which provide for spacing them the proper distance apart from side to side in the super. A fence provides this spacing when the plain sections are used.

Apparently it is about as much a matter of personal choice as anything else as to which style of section shall be used. It would be inadvisable to use any style of section other than one of these three. A full sheet of thin or extra thin foundation should be used in the sections.

For the production of honey for home consumption to be used in the comb, the shallow frames are best. The honey can be cut

from these leaving about one-half inch attached to the top bar, which serves as a guide for the bees when the frames are returned to them for refilling. More honey per hive can be produced in the shallow frames than in sections and with less labor and expense and less trouble from swarming.

TOOLS AND APPARATUS

Smoker

Protection from the attacks of bees is one of the essentials in successful beekeeping. Fortunately for the person who has to deal with bees, much stinging can be avoided. When smoke is blown on bees they fill with honey, and when so filled seldom venture an attack. This will have little or no effect upon angry bees when on the wing. In order that the smoke may be applied as needed a

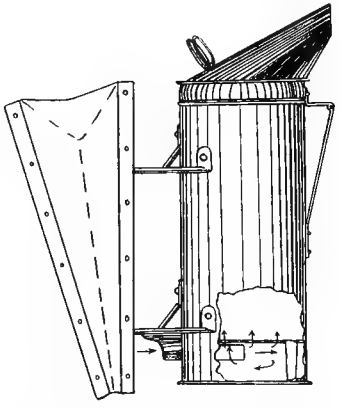


Fig. 16. Bee smoker (redrawn).

smoker (Fig. 16) is used in which is burned almost any inflammable material, wood in all probability being the best. Tobacco is not used. So far as its effect upon the bees is concerned the smoke from any fuel appears to differ little if at all, from another, except that greasy waste which is sometimes recommended and tobacco are to be avoided as a bee-smoker fuel.

Smokers are made in two types: the hot and the cold blast. The hot blast smoker forces the air *through* the fire and out the nozzle, carrying the smoke with it. The cold blast smoker forces the air *over* the fire and out the nozzle drawing out the smoke. This latter type cannot be recommended.

There are three sizes of the hot blast smoker known as the Junior, Standard and Jumbo, having a 2 1/2-inch, 3 1/4-inch and 4-inch

firepot, respectively. The Standard size is recommended, although for a very few colonies the Junior is satisfactory. It is believed the extra expense of a copper rather than a tin firepot is not warranted.

Veil

It is seldom safe to manipulate bees without some protection from stinging on the face although experienced beekeepers who well know the bees' behavior sometimes work without a veil.

Fig. 17. Cotton bee veil (Root).

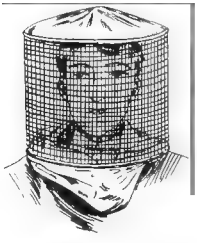


Fig. 18. Wire cloth bee veil (original).

Protection for the face is of two general styles: the soft veil, made of thread or cloth which can be folded in small compass and is worn over a hat (Fig. 17), or the stiff veil made largely of wire cloth which cannot be readily folded (Fig. 18). The wire cloth veil has all the desirable features needed in a bee veil, possibly, excepting ease of folding. It is not easily torn and stands out from the face in spite of wind. This is commonly called the Alexander veil, although Langstroth* illustrates it in his book dated 1853. It can readily be made at home. A piece of painted wire cloth mosquito bar 9 1/2" X 30" is fastened in the form of a cylinder, first having

*Langstroth, L. L. 1853, Langstroth on the Hive and Honey Bee.

turned over 3/8 inch of each edge to take care of the cut wire ends. A circular cloth crown is then sewed over one end of the cylinder and a cloth skirt 9 1/2 inches deep is sewed on the other. Around the bottom of the skirt is a 1/4-inch hem. A piece of cloth 9″ X 12″ is then sewed on the outside of the cylinder on what shall be the back, to provide shade for the back of the head and also to prevent the bee stinging through at this point, for when worn the veil touches the head at the top and back. To make the veil complete thread a stout cord 3 yards long into the hem of the skirt drawing the ends out of the hem 3″ each side of the centre of the front of the veil so there is a space of 6 inches in front where the cord does not run through the hem. The veil is worn without a hat. To adjust the veil place it over the head with the cloth covered wire at the back, grasp the ends of the string in each hand, pass them around the back, then to the front of the body and tie. In the commercial Alexander veil no provision is made for the string in the bottom hem. Without this, easy and safe adjustment is not possible.

Gloves

Until confidence and experience is gained the operator may use

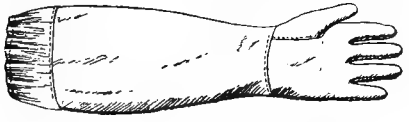


Fig. 19. Bee gloves (original).

long gloves (Fig. 19) to protect the hands and forearms from stings. Those made for the purpose can be bought at beekeepers supply houses, or a fairly satisfactory substitute may be found in a pair of canton flannel gloves thoroughly wet with linseed oil and sun dried. This makes them practically impervious to stings. If it is desired, old stocking tops may be added as protection for the forearms. Rubber gloves are not satisfactory for this purpose.

Hive Tool

Some instrument is needed to pry apart the frames and the supers and hive bodies. Many tools are made to serve this purpose, such as an oyster knife, screw driver, old jack knife, part of buggy spring, etc., but a tool for the purpose will be found to be a worth-while investment. The Root tool (Fig. 20) is a good one. It has been improved by Dr. C. D. Cheney, a New Jersey beekeeper, by making the straight end a quarter circle instead of square and also slightly

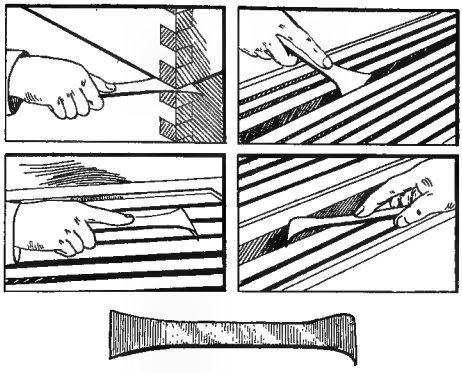


Fig. 20. Root hive tool (redrawn).

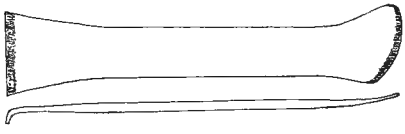


Fig. 21. Cheny hive tool.

bending the same end in the direction opposite to the end which is bent for scraping (Fig. 21). When two supers suddenly part when inserting the Root hive tool the thumb nail is sometimes injured. With Doctor Cheney's modified hive tool this does not occur.

Bee Escape

When supers are to be removed from the hive it is desirable that the bees first be removed from them. When producing extracted honey it is possible to do this by driving the majority of them from the super by smoking and brushing off the remainder with a bee

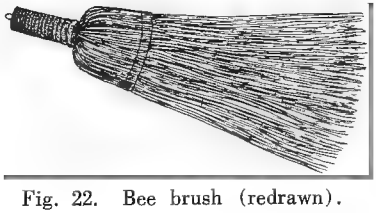


Fig. 22. Bee brush (redrawn).

brush made for the purpose (Fig. 22). This is impractical when comb honey is to be taken as the bees, following their instinct to fill with honey when smoked and finding no uncapped honey in the super, make holes in the cappings which spoil it for marketing.

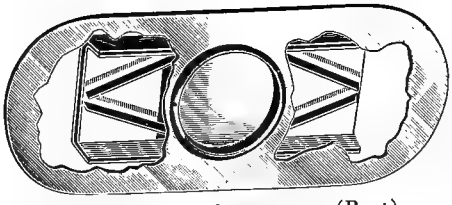


Fig. 23. Porter bee escape (Root).

To avoid this damage a Porter bee escape (Fig. 23 is used. This permits passage of the bees in one direction only. This is placed

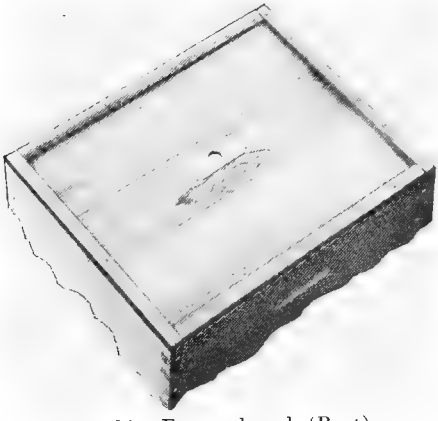


Fig. 24. Escape board (Root).

in the escape board (Fig. 24), and the board is placed between the super to be removed and the brood chamber. Usually within half a day the bees will have left the super, and it can be removed without damage to the honey or annoyance from the bees.

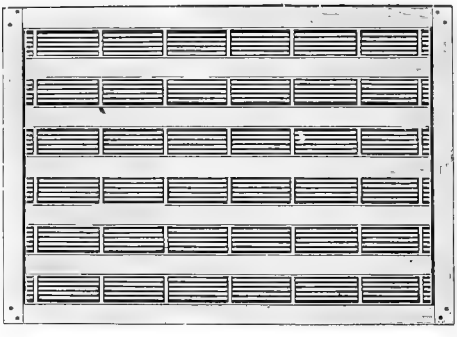


Fig. 25. Queen excluder (Root).

Queen Excluder

The queen excluder (Fig. 25) is a device made either of per-

forated zinc or a series of parallel wires with openings of such size that the workers can pass through but the queen and drones, because of the larger thoraces, are debarred.

This is used in extracted honey production to confine the queen and her brood-rearing operations to the brood chamber.

Uncapping Knife

When extracted honey is to be produced, before the honey can be extracted, the cell cappings must be removed. This is done with a

Fig. 26. Bingham uncapping knife (Root).

specially constructed knife. The Bingham uncapping knife (Fig. 26) is recommended. For a large outfit a steam heated knife is sometimes used, but it has no value to the side-line beekeeper. Some good beekeepers find a large straight bladed butcher's knife satisfactory for uncapping.

Honey Extractor

After the cappings are removed from them the filled combs are placed in the honey extractor, rapidly whirled, the honey thereby being thrown out, and the comb is returned for refilling. The extractor removes the honey from only one side of a comb at a time and the combs must be turned before the other side is extracted. The wire cloth baskets (comb pockets), in which the frame is held during

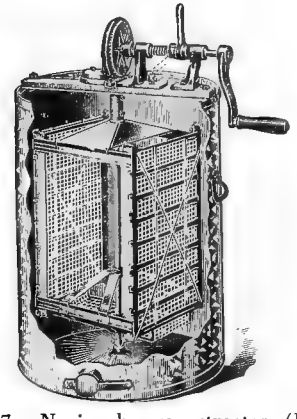


Fig. 27. Novice honey extractor (Root).

extracting in the reversing extractors, swing like a door on its hinges, allowing both sides of the comb to be extracted without removing it from the comb pocket. The non-reversible machines make it necessary to remove the comb from the pocket to reverse it. The smallest size extractor made, the Novice (Fig. 27) does not have the frame reversing feature. This, however, is not so essential as one might be led to think. This machine does work equal to a larger and more expensive one, and the non-reversible feature is not missed when the trick of working without it is learned. When the honey has been thrown from one side of the combs, cross the arms and grasp a frame in each hand. Remove them from the extractor, uncross the arms and return the frames. This accomplishes the reversing and requires no more time than does reversing with any of the reversible machines except the large automatics. For a large business a power automatic machine should be used.

Settling Tank

Even though but a few hundred pounds of extracted honey is produced, a settling tank should be provided. A tight wooden barrel with one head removed and a syrup gate near the bottom may answer fairly well if coated on the inside with paraffine, but a metal tank is much to be preferred. There is no need for any straining device, the settling tank sufficing except for the last few pounds of honey in the tank.

Cappings Press

When uncapping combs to be extracted, some utensil is needed to support the comb, receive the cappings with the adherent honey and to separate as much as practical the honey from the wax. This end is very well accomplished by the adaptation of a cider press to this purpose, which has been developed by Mr. O. W. Bedell, Earlville, N. Y.

A cider press with an extra circular slatted bottomless tub is secured, and the table on which the tub is used in pressing ground apples is made to extend about twice its length beyond the original, the projecting end being supported by legs and inclined slightly from the press proper. A piece of lumber with projecting nail point is supported across one of the slatted tubs which is placed at the outer end of the extended table. One end of a filled frame is placed on and supported by the nail point while the cappings are removed, slicing downward. The cappings fall into the tub, and much of the adhering honey drains away and runs off the end of the inclined table into a vessel placed to receive it. When a

tub is full it is placed under the screw of the press and pressure is gradually applied while the second tub is being filled. By the time the second tub is filled the maximum pressure has been applied to the first, and the cake of wax may be removed for further treatment.

COMB HONEY

Section Foundation Cutting Box

The foundation for sections comes from the factory in sheets, which when cut into four equal parts will fill four sections.

To cut these strips accurately and quickly a mitre-box-like device

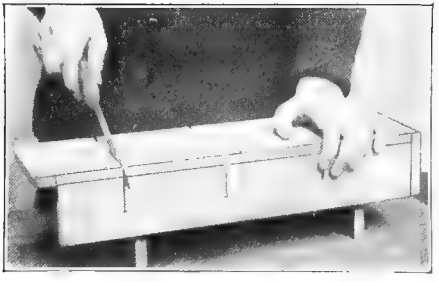


Fig. 28. Foundation cutting box (Root).

may be used to advantage. (Fig. 28). This differs from a carpenter's mitre box in that the cuts through the sides are made from the bottom instead of the top and also in that it has a follower board with two deep cleats. Six or eight sheets of foundation are placed in this, and the follower placed upon them. The box is then inverted, and with a sharp knife by quick strokes through the saw cuts the whole lot of foundation is cut at one operation.

Section Folder

The regular bottom board can be made to serve as a section folder even though a considerable number of sections are to be put up. After the V cuts in the sections are dampened the lock corners may be pressed together by hand and the section placed in the angle formed by the side and back rails of the bottom board with the deep side up. About three light blows with a hammer on the lock corner of the section slightly crushes the corner and locks it.

The Hubbard section press is an excellent piece of apparatus, although any employing the same principle would serve equally well.

Section Foundation Fastener

Another home-made device giving satisfaction is the foundation

Fig. 29. Foundation fastener.

fastener (Fig. 29). This is a board 1/2 inch thick and two inches longer and wider than four folded sections lying flatwise end to end. On this board is nailed four blocks, each long and wide enough to fit loosely inside a folded section and one-half the thickness of the section minus one-half the thickness of the foundation used. These blocks are nailed to the board in such a manner that when four sections, just as they fit in the section holder, are placed over them the sections fit without space between. There is also needed one or two pieces of galvanized iron or similar weight sheet metal slightly less in width than the inside width of the section and about 5 inches

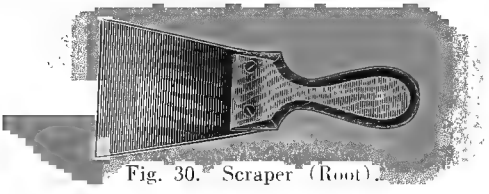


Fig. 30. Scraper (Root).

long. A rounded stick about 5 inches in length has a slot 1 1/4 inch long sawed centrally in its end, into which the sheet of metal is pushed and nailed. Still better is a wall scraper (Fig. 30) of the proper width. Provision is made for heating this plate. A kerosene lamp may be made to serve the purpose.

The multiplex (Fig. 31) foundation is a good one.

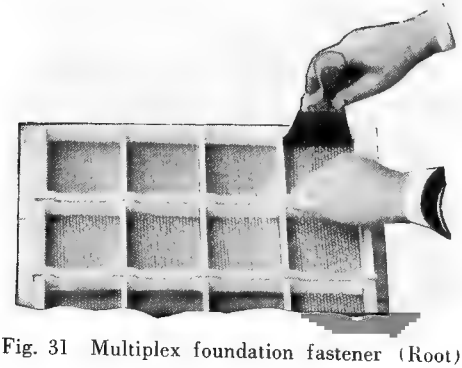


Fig. 31 Multiplex foundation fastener (Root).

Although it is much easier to learn the method of manipulating the colonies by seeing an experienced person operate, an effort will be made to direct a person not permitted so to observe.

The smoker should be fired and should be working in such a way that a rather dense cloud of smoke can be forced from it if necessary. After the veil and gloves are adjusted, if gloves are desired, the operator should approach the colony from the rear or side and send a few gentle puffs of smoke on the bees at the entrance, the guards, which will send them into the hive sounding the note of alarm. Should the few puffs of smoke not have the desired effect more may be used, holding the smoker a foot or more from the entrance. No one can tell exactly how much smoke will be needed for a colony, and the amount needed may differ with each colony. It is inadvisable to use an excessive amount, as this may defeat the purpose for which the smoke is used by driving the bees out of the hive.

The theory of smoking bees is that when smoked they fill with honey, and when in this condition they are much less likely to make an attack.

When the guards have been driven in by smoke and a roar is heard inside the colony, gently loosen the hive cover with the hive tool and when a crack is made large enough to admit smoke but too small to allow bees to escape, send some smoke into the crack to drive away bees which are there ready to emerge. Then raise the cover giving enough smoke across the tops of the frames to drive the bees down between the combs, but no more. It is always advisable to use the smallest amount of smoke which will accomplish the desired purpose. An excessive amount at this time will stampede the bees out the entrance of the hive. With the hive tool break the sealing between the first and second and third frames from the side of the hive near the operator. This will permit the removal of the second frame from the hive side, by prying it up at one end, grasping that end with one hand while the other end is pried up enough to be seized by the other hand and gently lifted from the hive.

The desired frame is more easily and safely removed if the frame on either side of it is pried away from it to provide more space for its withdrawal.

It is best, when possible, to work at the side of the hive which will allow the sun's rays to be at the operator's back. This gives a better view of the interior of the hive.

If it is desired to remove more frames for examination, the first one removed may be stood on end leaning against the front corner

of the hive. Any bees which may drop from the frame may then walk into the hive without disturbance. It is best not to dislodge bees from the combs unnecessarily.

With one frame removed any other frames may be removed with less difficulty.

During the examination, should the bees show a decided disposition to come to the top of the frames, gentle smoking should be used to keep them down out of the way.

When the examination is finished care should be used in replacing the last frame in order that bees be not killed or angered. Should many bees be on the last comb replaced they may be shaken in front of the hive out of the way and allowed to run in.

STINGS AND REMEDIES

Much stinging in handling bees is unnecessary and it is possible to work with them without receiving stings. However, the extreme care and amount of protection necessary to insure entire freedom from stings results in the practical beekeeper using less care and protection and taking a few stings.

The effect of stings varies in different persons, and there is developed in many persons a certain amount of immunity to the effects of the sting poison. There seem to be no grounds for the belief that the pain is less to an old beekeeper than to a new one when the same amount of poison is received.

That part of the stinging apparatus of honey bees which enters the flesh of its victim is composed of three horny parts. Two of these are armed with barbs. These are held together by an incomplete sheath along which the barbed parts glide as they are alternately driven into the flesh by muscles. The union of these three parts forms a canal leading to the tip and connecting at the base with the poison sac. Through this canal the poison is injected into the wound made by the sting. The longer the sting is allowed to remain in the flesh the deeper becomes the wound and the greater the amount of poison injected. If, therefore, the sting is removed quickly the unpleasant results will be less.

Experienced beekeepers acquire the habit of striking the hand or other part stung with a glancing blow the instant the prick of the sting is felt, killing the bee and dragging the sting from the flesh at the same time. The attempt should never be made to remove the sting by grasping it between the thumb and finger. The poison sac, which is torn from the bee when it stings, as well as the muscles which control it, is so small in proportion to the fingers and so close to the skin that in the attempt to grasp it, its entire

contents are squeezed into the wound. The sting should be scraped out with the finger nail if the glancing blow fails to dislodge it.

Carlet says that the sting poison comes from two glands, one of which secretes an acid and the other an alkali, the former being the larger. Neither of these substances alone produces unpleasant effects. The puncture made by the sting is so minute, and swelling, if it occurs at all, follows so quickly, that it is next to impossible to have a remedy follow the path of the sting.

The practiced beekeeper considers that the best remedy is to remove the sting as quickly as possible and forget it. Sometimes he moistens the injured part with spittle which may or may not have any effect.

In case of severe stinging, local application of hot cloths coming from salt water has been recommended, and the heart action should be stimulated if necessary.

DEVELOPING THE COLONY PREVIOUS TO THE HONEY FLOW

The following suggestions are intended to apply to places where the surplus honey is secured from clover or some plant giving the maximum yield during June and July. Where the surplus honey flow occurs later in the season a slight modification, so far as dates are concerned, will be necessary. As Doctor Phillips has well said, "The two essentials in beekeeping are to get the maximum number of bees in a hive by the time the surplus honey flow starts and to keep them contentedly working together during the honey flow."

In order that we may secure the first essential it is necessary to lay the foundation the year previous. The first step is to see that by August 1 each colony is headed by a young, vigorous Italian queen; that each has at least 3 to 4 frames of brood, and that there is at least 15 pounds of stores in the hive at all times. Mr. G. S. Demuth is authority for the statement that a colony with less than this amount of stores will curtail brood-bearing.

It should be the beekeeper's purpose at this time to have conditions such that brood-rearing will progress without interruption, so that a good colony of young bees may be on hand for winter. Provisions should be made for an ample quantity, forty pounds being not too much of good stores for winter, substituting sugar syrup two parts sugar, one part water for poor stores when necessary. It is also desirable when the 8- or 10-frame Langstroth hive is used to winter the bees in two stories. The desirable condition is that the bees shall pass through the inactive period of the year with

the smallest possible expenditure of energy. Doctor Phillips has likened a bee to a miniature dry battery which cannot be recharged when the energy has been exhausted. Therefore, to insure the most energetic colony of bees in spring they should be thoroughly insulated from the winter's cold by an outer case around the hive large enough to provide space for insulating material between it and the hive; that there shall be an ample windbreak and that the bees shall be left undisturbed. This combination of young bees, good stores, insulation and protection from winds is necessary for best results. If any one of these factors is absent the results will be proportionately less satisfactory.

While the minimum of activity on the part of the bees is desired through the winter, when spring with its brood-rearing activity arrives it is desirable that this activity be at its maximum in order that the colony may attain maximum strength as early as possible. When the steps as suggested have been taken, there is nothing the beekeeper can do to facilitate matters since the colony has all the essentials for rapid breeding—a vigorous queen, an abundant supply of stores and ample protection against temperature changes. Instead of using a large part of their energy in maintaining the brood-rearing temperature (96°F.) they can use all their energy in producing more bees.

When the maximum strength of colony is reached just as the surplus honey flow begins without the swarming impulse having been started, the maximum crop of surplus honey will be secured. In just the proportion that the beekeeper fails to have his bees reach this condition, will he fail to secure the maximum yield. If, on the other hand, maximum strength is reached previous to the beginning of the honey flow, care must be used to prevent the colony dividing its energies by swarming, or, balked in this, get sulky and loaf.

ADDING THE SECOND STORY

If the bees have not been wintered in two stories, a second one may be added during the building-up process in spring. It is now believed that a desirable queen is one which will need more room for eggs than is provided by the ten-frame hive, allowing the necessary room for stores. When in the spring a colony has six frames or their equivalent full of brood before the honey flow arrives, it is advisable to add a second brood chamber. If ready-built combs are on hand they are desirable at this time; otherwise, full sheets of foundation should be used. This second chamber is put above the occupied one, and one or two frames of unsealed brood from the lower chamber placed in it in exchange for the frames of empty comb or foundation as the case may be. The two frames of brood

should be put in the center of the second story, and the two combs put below should be put at the side of the brood-nest, not between frames of brood.

The nurse bees come up to care for the unsealed brood and the warm air ascends to the upper chamber, making its occupancy by the queen more quickly assured.

SWARMING AND ITS CONTROL

Factors Favoring the Swarm Impulse

While we may not be able to give a very satisfactory reason why bees swarm, we know some of the factors which tend to stimulate the swarm impulse. These are lack of room for the deposition of eggs (empty comb room), lack of room for the storage of incoming pollen and nectar, an old queen, a large number of drones, lack of ventilation and, co-related with this, comb spacing. These factors are under the control of the beekeeper.

Comb Room

If a queen is given the run of two 10-frame bodies this should afford sufficient comb room for the reception of her eggs provided sufficient storage space is also given.

It sometimes happens that the flow of nectar is so heavy that twice the comb space is occupied with the raw nectar as will be the case with the ripened honey. In such times there is a tendency, unless the beekeeper uses care, to crowd nectar into the brood nest, thus restricting the queen's activities. When producing extracted honey this matter of storage space is more easily handled, since a superabundance of room is not likely to cause undesirable results. In the production of comb honey the addition of an excess of room may result in too large a proportion of unfinished sections.

The person, therefore, who produces comb honey must expect to be obliged to contend with swarm preparations, as comb-honey production requires conditions which favor such preparations. To get well filled sections crowding is necessary, and this will aggravate the swarming tendency.

Queen

An old queen produces more drone eggs than does a young one, and the bees show a greater tendency to develop the swarming impulse when an old queen heads the colony. A vigorous young queen helps to overcome the tendency. Requeening every year is advocated by some beekeepers, while others claim that a well-reared queen is

equally efficient the second season. Few, if any, favor retaining a queen after she has given service two seasons, unless she is kept for breeding purposes.

Drone

A great horde of drones in the hive adds to the general unrest and serves to aggravate the swarm impulse. Try as we may to prevent, the bees will raise more drones than will ever be needed. The remedy, besides having a young queen, is to provide such conditions within the hive that drone-rearing will be restricted. This may be accomplished by using full sheets of foundation in the frames, and better results will be had when medium brood foundation is used rather than light brood foundation. The light weight is too much subject to damage by the bees, often resulting in "sagged" cells of such a size that drones are reared in them.

Ventilation

Bees have a ventilating system which provides that there shall be a current of air passing through the spaces within the hive in summer. This insures that the temperature shall be kept below a point where the combs and brood would suffer damage. When a considerable number, say two dozen, of bees are seen on the alighting board with heads turned towards the entrance vigorously fanning with the wings they are drawing a current of the air out of the hive and another current rushes in to replace that withdrawn. Not alone are the bees working on the alighting board in this manner, but there are bees so working all through the hive. This takes a great many bees from other work and creates a condition of unrest within the hive favoring the swarming impulse. This condition can be remedied to a considerable extent by providing more space for the egress and ingress of air. This is accomplished by raising the front of the hive from the bottom board and supporting it by a block under each front corner, the block to be 3/4 inches or 7/8 inches thick. This provides a front entrance 3/4 or 7/8 inches deeper as the case may be, and also provides a triangular opening on either side, securing much better ventilation. Sometimes the back of the hive is similarly raised.

The hive should be replaced directly on the bottom board by the time cool nights occur in the fall, if not done before this time. This blocking up should not be done unless the bees show by their excessive fanning that it is needed. No damage will occur to a colony so manipulated when it is strong enough to indicate this need of more ventilation.

Comb Spacing

When Mr. Langstroth invented the movable comb hive in 1851 he made it so that the combs were spaced 1 3/8 inches from centre to centre, and this is the comb spacing provided by the Langstroth hive as today manufactured.

About 1858 when Mr. Quimby tried the movable hive, he changed some of the dimensions, retaining the essential feature of mobility of the combs and declared 1 1/2 inches to be the proper spacing. The Dadants at Hamilton, Illinois, now operating 800 colonies of bees, aodpted the Quimby spacing (1 1/2 inches) and have used it about 50 years. Dadants claim a much smaller proportion of swarming than do other beekeepers, and contend that the increased spacing is an important factor in swarm prevention. This is really an increased ventilation measure, as the brood is the same thickness as in combs spaced 1 3/8 inches apart thus providing an added eighth of an inch between the combs of the brood, facilitating ventilation.

Those using the ten-frame hive may secure the one and one-half inch spacing by leaving out one comb and spacing the remaining nine an equal distance apart.

Destruction of Queen Cells

Another swarm prevention measure is the destruction, as often as once in seven days, of all swarm queen cells started.

When a swarm queen cell contains an egg or a grub but two or three days old, the destruction of such cell by jabbing with the finger or hive tool and providing increased room and ventilation will often be sufficient to cause the bees to abandon further efforts toward swarming. Damaging a queen cell is as effective as removing it, as the bees do not repair one which has been damaged. When, however, the cell has an older grub in it or is sealed, rarely will anything short of swarming, either natural or artificial, cause them to settle down again to honey production without a period of loafing. Bees balked in their efforts to swarm often become so demoralized as to be of no value as producers for several days. They lose what Mr. Demuth has termed the "colony morale." It is of the utmost importance that this be preserved if the most effective work is to be done by the bees.

SWARM CONTROL

Clipping the Queen's Wings

When a colony is found with swarm preparation measures so well under way as to make preventive measures seem inadvisable,

it is still unnecessary to have the swarm issue from the hive uncontrolled and possibly be lost.

If someone can surely be present when the swarm issues to care for the queen, her wing or wings may be cut off rendering her unable to fly with the issuing swarm. The attendant may then find the queen on the ground in front of the hive, put her in a small wire cloth cage for safety, remove the hive which cast the swarm to a new stand about 10 feet away and place a new hive prepared for a swarm where the old one stood. Presently the swarm will miss its queen, return to the old stand and, as they run in the entrance, their queen may be released and allowed to go in with them and the hiving is done. However, should there be another queen on the wing at this time the swarm will probably go off with her.

Artificial Swarms

The actual issuance of the swarm with its attendant uncertainty may be avoided. During the season when swarms may normally be expected, a weekly examination should be made of all colonies which have attained the strength which would warrant their making swarm preparations. If at these examinations there is found a queen cell with only an egg or very small larva this may be destroyed and normally the colony is safe for another week. If the ventilation and comb room needs of the colony are given proper attention the colony may make no further swarm preparations, but this must be determined by subsequent examinations. When swarm queen cells are discovered at a stage beyond that where it can be reasonably expected that their destruction will result in the colony abandoning further swarm preparations, the cells may be left until sealed. Then the queen with the frame on which she is found can be placed in a hive prepared for a swarm and placed on the stand of the old colony after having moved the old colony to a new stand. The bees from 3 or 4 frames of the old colony should be shaken in front of the new colony. These, with the returning field bees, will constitute the "swarm." Do not shake a comb on which is a queen cell to be kept, but carefully brush off the bees from such a comb. Shaking may cause the queen to emerge from the cell with faulty wings. Being unable to fly she will become a "drone layer" and therefore will be useless.

After Swarms

The old fertilized queen goes out with the prime swarm. A colony may send out a second or third swarm and even fourth swarms may occur. Normal swarms after the first are headed by a virgin

unfertilized queen. When the bees decide no more swarms shall be sent out the surplus virgins are disposed of, and one is allowed to mate and carry on the work of that particular colony. If the beekeeper desires that none except the first or "prime" swarm shall issue he may go through the colony and destroy all queen cells except one. This plan has the disadvantage that it entails considerable labor, a cell may be overlooked, and it is impossible to tell whether or not the occupant of the cell which is left is normal. A better plan is to move the parent colony to a new stand at least ten feet away from any other colony, placing the swarm on the old stand. The parent hive may, after a week or two, be placed near the old stand if desired. This draws off the bees from the parent colony in such a measure that the surplus swarm cells will surely be destroyed by the bees and a normal one be left.

COMB OR EXTRACTED HONEY PRODUCTION

The conditions of honey flow will determine whether comb honey may profitably be produced. If the surplus honey flow comes from a source giving light-colored honey (buckwheat excepted) and the flow is very heavy, comb honey may be produced profitably. If on the other hand, the honey produced is dark in color and the flow is slow an attempt to produce comb honey will, except on rare occasions, result in unattractive combs. They will be unevenly filled, with different colored honeys, and an excessive amount of wax will be used in their construction. It is also possible there will be considerable discoloration due to the sections being in the hive a long time. All of these reduce the salability of comb honey.

Comb Honey for Home Use

If comb honey for home use only is desired it is more profitable to raise it in what are known as shallow extracting frames, excluding the queen from the supers with the queen excluder. With this style super something like fifty per cent more comb honey can be secured with less trouble with swarming.

When the honey is to be used it is cut from the frames and the frames again fitted with a full sheet of foundation, or half an inch of comb may be left at the top of the frame to serve as a starter, thus slightly reducing the cost. The use of a full sheet of foundation will be the most profitable, as the bees will more quickly build and fill a comb from a full sheet of foundation than will be the case with a starter only.

Commercial Comb Honey Production

Whether the beekeeper plans to produce comb or extracted honey, his first care should be to produce the largest possible colony by the time the honey harvest arrives. If the suggestions as outlined under that head have been followed the colony will be boiling over with bees in two stories when the blossoms open from which the surplus honey is gathered.

In producing comb honey it must be borne in mind that bees show a preference for large frames for storage as opposed to the pound sections; that new work (comb building) is best done when in close proximity to the brood, and that when the super in which comb honey is being capped is next to the brood chamber there is danger that some of the darkened wax from the brood combs will be carried above and used in the capping, thus spoiling its looks.

Reducing the Colony to One Story

With the first proposition in mind, if the colony has been built up to two stories it is necessary to reduce it to one story when the comb honey super is put on; otherwise, the super would be neglected and most of the crop stored in the deep frames.

When the surplus honey flow arrives the first move is to put all the brood in one body on the old stand, giving preference to the oldest; also put all the bees and the queen in this single story. The remaining brood, if any, and the combs are put on a colony not yet strong enough to do comb honey work, are used to make other colonies of the required strength, or enough bees are left with the brood to care for it and it is used to start new colonies.

Supering

The first super, fitted with full sheets of foundation, is placed on the prepared colony. It will clearly be seen that when a two-story colony is reduced to one and a half stories no measures will be needed to coax the bees into the super as there is no other place for them. They will be *forced* to occupy the supers.

The conditions which have been created by this manipulation are ideal for getting good comb honey work done, provided the beekeeper is able to keep the colony contentedly working together. It is also to be remembered that conditions have been created which favor the development of the swarming impulse. For this reason very close attention must be given to conditions in the brood nest in relation to swarm preparation measures.

If the honey flow is good the second super will be needed soon, perhaps within three days. It is desirable that there be work for

the comb builders at all times, keeping them occupied at some useful pursuit and out of the brood nest where their presence in great numbers would tend more quickly to bring on the swarming impulse.

The second super is added beneath the first when work in the first is well under way. Perhaps some storing has been done in it, but surely not so much as to be near the capping stage.

A general rule in comb honey supering is to place the new super under those already on the hive if the honey flow can reasonably be expected to continue, and if there is any doubt along this line place the new super on top.

The third super is added below the others, with number one and number two arranged above in the order mentioned. The fourth (if honey flow conditions seem to warrant) is added next the brood chamber with one, two and three above in the order named.

It will be noticed that this manipulation keeps the oldest super one super depth removed from the brood nest where it is reasonably safe from dark wax, and it also puts the new work next the brood chamber where it will be done with the greatest facility.

Adding supers in this manner provides considerable storage space for raw nectar, keeping it out of the brood nest with its attendant congestion and also facilitating evaporation. For a more detailed discussion of comb honey production than is possible in this work the reader is referred to Farmers' Bulletin No. 1039, "Commercial Comb Honey Production" by Demuth, which can be secured from the Department of Agriculture, Washington, D. C.

Comb honey production requires much guess work and judgment, both of which may fail the beekeeper because of unusual weather conditions, leaving him with a lot of unfinished sections on hand at the close of the season.

Extracted Honey Production

The extracted honey producer has the same problems as the producer of comb honey up to the time the surplus flow arrives.

With few exceptions extracted honey producers use the same frames and bodies for supers as are used for the brood bodies. The majority also allow brood-rearing in combs which are used for extracting combs if that adds to the convenience in manipulation.

It is a common practice, with nothing tangible to be said against it, to allow the queen free range of two and sometimes three ten-frame bodies until the surplus honey flow has been in progress for ten days or two weeks. To avoid the possibility of having brood in the extracting combs when extracting time arrives and also having

the first story vacant except for pollen, it is necessary that the queen be confined to the first story with a queen excluder.

It would be very desirable if the use of this implement could be dispensed with since it undoubtedly hinders, in a measure, the free passage of the bees to and from the upper stories. The Dadants claim to be able to do this with their large deep brood chamber and shallow extracting supers.

When the surplus flow has been on for ten days the queen should be confined to the first story by a queen excluder.

When it comes time to put the queen below, if the colony is but two stories high it is not absolutely necessary to see the queen. Put the queen excluder between the two stories, and four days later look for eggs in the upper story. If they are not present the queen is below and no further manipulations are necessary so far as she is concerned. If eggs are above the queen is also above, and the first and second stories may be made to change places.

Where there is an abundance of pollen it is sometimes advisable to sort over the combs and put those with considerable pollen in them in the first story.

Crowding the queen down into the first story at this time is not so likely to start swarm preparation measures since, when the honey flow is heavy, the queen does not get the attention from the bees she otherwise gets and she will bear the crowding without protest.

It seems to matter but little whether the new supers are added above or below those already on the hive when extracted honey is being produced, except that it may be well to remember the new super if it contains foundation will probably be worked out more quickly if it is next the brood chamber. If ready-built combs are used it is likely that it will not pay to lift off the supers partly filled to place the new one below.

Queens cells are sometimes started from brood in the second story above the excluder, and therefore a week after the excluder is in place these must be destroyed or used elsewhere if desired; otherwise, there may be an incentive to swarm due to the presence of the virgin in the second story.

HARVESTING AND MARKETING

Comb Honey

Although some comb honey is produced where the honey is not light in color, for the most part the beekeeper's energy is used to have light-colored honey only stored in the sections, and when so stored care is used to keep it from soil or stain from any source. For this reason it is the practice of the most successful comb honey

producers to remove the sections as soon as sealed, not individually, however, but by the superful, returning any sections which by chance may be unfinished. If supering has been done as fast as is advisable there will be no fancy sections (sealed to the wood nearly all the way around) but for the most part the row of cells next the wood will be empty (No. 1 grade). It is more profitable to produce grade No. 1 rather than fancy grade except for exhibition purposes. Comb honey no doubt acquires an increased ripeness and richness if left long with the bees, but since it sells largely on its looks the customer will not pay for extra quality. Its fine appearance is often injured when left long on the hive.

Removing from the Hive

There are times when the expert can safely remove comb honey from the hive without the use of the bee escape. It is seldom advisable for the expert and never so for the less experienced to dispense with the use of this device.

The bee escape permits the passage of bees in one direction only. It is placed between the finished supers and the brood chamber or the unfinished supers, and the bees go down through the escape. Since they cannot return, the super can be removed practically free of bees. If the escape board is put in position about three o'clock usually by ten o'clock the next day the finished super can be removed free of bees.

A word of caution should be given regarding the use of the bee escape. When this is in position on the hive ventilation to the super above is shut off and if the hive is so arranged on a hot day, the sun's heat may cause damage to the honey. If, however, the escape is put in place and the honey removed at the time suggested no harm is likely to occur. Should it be necessary to leave the escape in position through the heated part of the day, possible damage may be avoided by shading the hive with boards which project six inches on each side and end.

When the comb honey supers are removed, sometimes considerable propolis (bee glue) will be found on top the sections. It is well to scrape off most of this while the sections are still wedged in the super. A steel brush such as is used by butchers in cleaning the meat block serves this purpose well.

When removed from the super any propolis which is still found on the edges of the sections should be removed. The sections are then graded according to weight.

Two grades only are common: No. 1, including sections weighing 12 1/2 ounces net and over (1 ounce being allowed for the weight of the wood), and No. 2, weighing net between 10 ounces and 12 1/2

ounces. Anything lighter in weight than ten ounces goes into the "culls."

It is good business to enclose each section in a carton (Fig 32) for the sake of cleanliness, which is appreciated by most customers, and further, the carton provides space for advertising matter.

Fig. 32. Carton for comb honey (Root).

Marking With Net Weight

The law of New Jersey, as well as the Federal law, requires that each package of honey shall be marked with the net weight of the contents. In case of comb honey, which may vary considerably within a grade, it is permissible to mark the sections or carton "net weight not less than 12 1/2 ounces" for No. 1 grade, and "not less than 10 ounces" for No. 2 grade.

Fumigation

If damage from the attack of the larva of the wax moth seems probable, fumigation by carbon bisulphide will overcome this trouble. When using this drug two things should be kept in mind: first, that it forms explosive mixtures with the air, but the same care that is used in handling gasoline is sufficient to avoid trouble; second, the fumes of this drug are heavier than air and tend to settle to the bottom of the container. In using this fumigant, first. place the super full of sections on a flat surface with a whole newspaper beneath to help make an air-tight contact. For one comb honey super pour one teaspoonful of carbon bisulphide on the sections, cover with a single sheet of newspaper, put on another super, another charge of the drug, more paper and so on as high as desired, covering the top tightly. This arrangement prevents the effective fumes settling to the bottom of the pile and leaving the upper portion without an effective charge, as might be the case if the dividing sheets of paper

were not used. The charge for a full depth hive body would be a tablespoonful. If the drug runs on the comb honey no harm is done. Better results are secured when the temperature is 60°F. or higher. Full dependence on this for killing eggs should not be placed, since it sometimes fails. A second fumigation 10 days later, after all eggs have hatched, will get the creatures which have emerged in the interim.

Harvesting Extracted Honey

Supers of honey to be extracted, when the bees are kept near neighbors, should first have the bees removed by the use of the bee escape. It is possible when the bees are kept where no annoyance to neighbors can result from considerable excitement in the apiary to remove the bees from the combs by heavy smoking, shaking and brushing. This, however, usually gets the apiary in an uproar and may result in the less experienced beekeeper deciding that bees are undesirable property.

Extracting honey and working with wax is a mussy job, and it is good business to provide a room for this and other bee work only.

The honey house should have screened windows but a tight wooden door. The supers after the bees are removed should be taken into the honey house, which is provided with the extractor, uncapping knife, buckets, the settling tank and the cappings receiver and press.

The capping should be removed from the combs using the downward stroke of the uncapping knife.

The honey should be allowed to accumulate in the extractor until it reaches the level of the bottom of the baskets and then a pailful drawn off; then again allowed to accumulate. In this way the largest particles of wax will be retained in the extractor until the last and then strained through some very coarse material. This will provide against a great amount of wax particles being in the settling tank.

When, after a few days, the heavier and lighter particles which may have been in the honey have gone to the bottom or top, the honey may be drawn from the faucet without straining. When the settling tank is nearly emptied it may be tilted forward toward the faucet and clear honey drawn off until about the last ten pounds, which must be strained.

Returning Wet Combs to Bees

If a later honey flow is expected the supers should be returned to the hives to receive such flow. Even if no later flow is expected

it is good apiary practice to return the extracted combs to the bees in order that they may be cleaned of adhering honey before storage for winter. It is never advisable to put out such "wet" combs and allow the bees to help themselves, as this may result in some colony or colonies being robbed out and will nearly always result in damage to combs. The wet combs should be returned to the colonies in the evening just before dark. The excitement occasioned by the presence of these wet combs will have subsided by morning and no damage will be done.

Preparing Extracted Honey for Market

Extracted honey may be drawn from the settling tank into the retail packages or into the square 5-gallon can (Fig. 33) which is the common wholesale package.

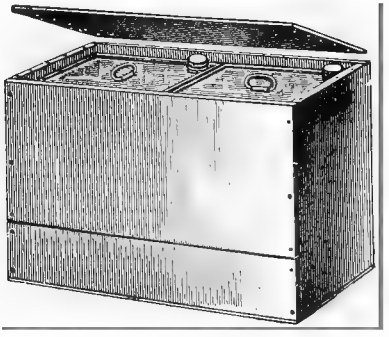


Fig. 33. Wholesale extracted honey package—two 5-gallon cans cased (Root).

Granulation—Practically all extracted honey will granulate sooner or later. Some persons prefer it in this form. Some do not so prefer it and suspect that something is wrong with honey when it granulates. The person who prepares honey for retail trade should do everything possible to prevent its being suspected of being adulterated. When retailed in pound jars (Fig. 34) or containers of less capacity the honey should be kept liquid. When sold in five and ten-pound pails it may be allowed to granulate and liquefying directions for those who prefer it liquid put on the container. (Figs. 35 & 36).

If honey is heated to 160°F. and the container sealed while hot, granulation will be very much retarded, if not entirely prevented. When heated above 160°F. the color and flavor may be changed in an undesirable manner. Honey heats through very slowly. For this reason a water bath is the safest method of heating it so far as overheating is concerned. If retail packages are filled from the settling tank they may be heated in this manner before sealing.

Fig. 34. Honey jars Root).

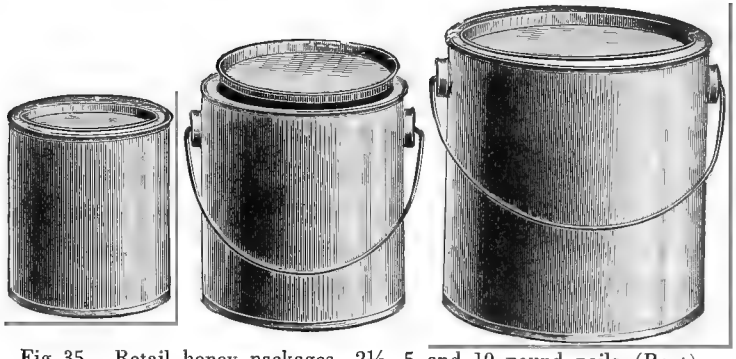


Fig 35. Retail honey packages—2½, 5 and 10 pound pails (Root).

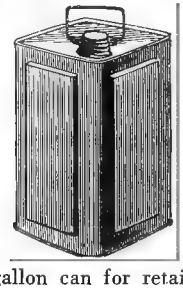


Fig. 36. One-gallon can for retail trade (Root).

Heating to 120°F. and holding at that temperature for forty-eight hours will cause the honey to remain liquid longer than a higher temperature for a short time.

Honey which has granulated may be restored to the liquid state by this method, and if not overheated is not noticeably changed.

There is much to be said in favor of doing all possible to dispel from the minds of the general public the idea that granulated honey should not be eaten. Many who have not had the opportunity to use it in this form are delighted with it, and it is possible that most of the extracted honey could be disposed of in the granulated form if beekeepers generally used their influence in this direction. This would save the beekeeper an immense amount of worry and unnecessary work.

Wax

After the honey has been pressed from the cappings they may be melted in an abundance of hot water and practically all the free wax dipped from the top.

Rendering Old Combs

It sometimes happens that the beekeeper has old combs which, by reason of damage or disease, he wishes to render into beeswax. If there is a hundred pounds of such material it will pay well to ship it to some reliable wax-rendering plant which will usually get enough additional wax from it to pay the charges, and an exceedingly disagreeable job is avoided. If the beekeeper has but a small amount, a good quantity of wax may be secured by crowding the old combs tightly into a coarse burlap bag and boiling in some large vessel. It is suggested, to avoid accidents, that this be done out of doors.

While the boiling is in progress the bag should be prodded with the end of a board to facilitate the free wax coming through the meshes of the bag. When there seems to be no more wax escaping from the bag, cause it to sink to the bottom of the vessel with some weight, remove the source of heat, and when the water is cold the cake of wax can be lifted from the surface. While this does not get all the wax, it gets all that it will pay to recover where the amount of material is small.

If old combs infected with American foulbrood are to be shipped to a wax-rendering plant, unless they are entirely free from honey, they should be boiled before shipment to prevent the possibility of contagion by means of dripping honey being spread on the way or anywhere the smeared car may go. The laws of some states prohibit the shipment of such infected material.

Marketing

New Jersey beekeepers for the most part have a peculiar advantage in that there are so many opportunities for the disposal of

honey locally. A great amount is disposed of in the beekeeper's own or nearby towns, and it is certain that much more could find an outlet in this manner, as there are annually many tons of honey shipped into this state in packages.

The roadside markets are another outlet for the crop. Some beekeepers in the state find their own crop entirely insufficient to take care of this trade.

It has been suggested that trade could be stimulated by giving demonstrations in local groceries. The groceryman usually welcomes such advertising.

If a New Jersey beekeeper finds himself with more of a crop than he can retail readily and cannot sell to someone with a trade larger than his production, the principal honey market of the East, New York, is almost at his back door. This insures the smallest charge for transportation to the wholesale market.

QUEEN INTRODUCTION

It is gratifying to those who are interested in the advancement of bee culture to note the increased interest in better stock.

The first bees are said to have been brought to this country by the Spaniards in the 17th century. These were blacks. In 1861 the Italians were introduced. Other races have been tried but none have measured up to expectations, and now there is rarely found in the United States any race except blacks or Italians or crosses of these two.

The Italians have proven to be so much superior to blacks that it is highly desirable that they supplant them.

It is fortunate that there are persons giving their time to the production of good Italian queen bees for sale, and also that it is a comparatively simple matter to get them from the breeder's yard to that of the purchaser.

Many practical beekeepers requeen all colonies every year, while a few believe they can get two years' good service from a queen.

If a queen is markedly poor, or allows her colony to become badly infected with European foulbrood, a new queen should be introduced as soon as practical. If there is not the urgent need of a new queen the desirable time to requeen is during July or the first week in August. This gives the beekeeper time to get in a second queen, should the first be rejected, in time to produce two generations of brood, which should result in a sufficient number of young bees for the winter colony.

An old queen frequently ceases laying so early in the fall that the colony goes into winter quarters with a large proportion of

old bees. This results in a high winter mortality and, as a consequence, weak colonies in the spring.

Removing the reigning (if that word may be used in this connection) queen and safely substituting therefor the purchased queen, presents some difficulties even to some apiarists with considerable experience.

Removing the Old Queen

A colony will not accept another queen so long as one is already in the colony, and therefore the old queen must be found and removed.

The most formidable part of the operation of requeening is removing the old queen. This is especially true if the bees are black or hybrids, since these, under manipulation, display an excitability much resembling the behavior of a nest of large black ants when disturbed. This excitability is shared by the queen, making it more difficult to locate her.

The writer knows of no rules which are of much value in finding the old queen. If anywhere in beekeeping there is such a thing as luck he believes it is manifested during this operation.

There are, however, some suggestions which may prove helpful in finding black and hybrid queens, especially, and which also apply in a lesser degree to locating Italian queens.

It is desirable that the colony be manipulated as gently as possible and that the smallest possible amount of smoke be used in order that the bees be not stampeded.

It is rare except in a colony much overcrowded or which has been stampeded by too much smoke to find the queen on the outside frame. It is therefore safe to defer looking for the queen on this frame until the others have been examined and the queen not found on them. It is quite common, then, first to remove the frame which is second from the hive side. As soon as this frame is lifted from the hive the operator should hastily glance at the comb in the hive. Many times the queen will be seen on this comb running toward the bottom in an endeavor to reach the dark unexposed side. Should she be seen, the comb on which she is found should be quickly lifted from the hive to prevent her getting off on another comb. Should the hasty glance not reveal the queen, the comb in hand should be examined.

This process is repeated, placing the removed combs into an extra hive body, until the queen is found or the examination of all combs fails to reveal her presence. Occasionlly she will be found on the hive side or bottom board after all combs have been removed.

If this operation fails to disclose the queen's whereabouts the

combs should be returned to the original hive, giving them another careful examination while so doing.

The whole process may be repeated if necessary, but it is advisable when practical to allow the bees to become reorganized before making a second attempt to locate the queen in the same manner.

If it is necessary to get the queen quickly and the operator's time is limited, the bees may be driven through a queen excluder and the queen secured.

The process is as follows: Provide a hive body equipped with drawn combs, or if they are not conveniently at hand frames of foundation may be used. Empty frames give poor results. Place the body with combs on a bottom board beside the hive to be operated on. On top the prepared hive body place a queen excluder and above this the hive body containing the queen desired. Drive the bees down through the excluder by vigorous smoking, taking out the frames one by one and shaking off any adhering bees inside the hive body. As the frames are removed for shaking have in mind the possibility of seeing the queen on one of the combs or in the mass of bees on top the excluder. By smoking keep the bees from running over the top of the hive. If not located before, the queen will be found after all combs have been removed, trying to escape through the excluder into the lower hive body. After she is secured the hive should be restored to its former condition. Should this operation be attempted during a time when robbing is easily started extreme care should be used to prevent this.

Introducing the Queen

The methods of queen introduction may be classed under two general heads—direct, in which the queen is at once free to go where she will in the hive; and indirect, in which the queen's movements are restricted by some sort of cage from which she is later released by the bees or the beekeeper.

Direct Methods—There are a number of ways of applying the two classes of introduction. Under the first head may be mentioned the smoke method, in which the bees are thoroughly demoralized by excessive smoking and the queen allowed to run in at the entrance while they are in this condition; the honey method, in which the queen is immersed in about 1/2 cupful of diluted honey and honey and queen poured on the topbars of the open hive; and the fasting method, in which the queen is placed in an entirely empty cage and left until she shows signs of weakness from lack of food when she is released on top the frames. The time necessary to get a queen in the proper condition by fasting will depend upon whether or not she has been actively depositing eggs immediately previous

to the fasting. A queen actively laying may perish from hunger in forty-five minutes, while one which has not deposited eggs for a considerable time may show no effects from an hour's fasting.

The essential thing is that the queen be in such condition when put into the colony that she will request food. If the bees at once feed her no fears need be entertained for her safety.

If a direct method is desired the fasting or honey method is recommended. Very few have had success with the smoke method.

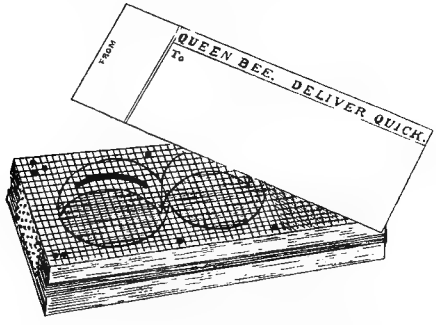


Fig. 37. Queen cage (original).

Indirect Methods—Indirect methods are used more than are others, probably because less labor is entailed and if the queen is a purchased one she is already in a cage (Fig. 37) which well serves the purpose of an introducing cage. The mailing cage may be placed above the frames if the hive has an inner cover by turning this cover top down, placing the wire cloth of the cage over the space between two frames.

If the colony is populous enough so that the bees hang down to the bottom board the queen cage may be pushed into the entrance with the wire cloth up.

The cage may also be placed between two combs, although this spreads the combs so that if there is a honey flow extra comb may be built in the gap, and, further, it is necessary to remove one frame to provide room for the cage. Always arrange that the bees in the hive will have access to the candy plug in the end of the cage and to the wire cloth. Do not dequeen a colony in anticipation of the reception of a queen, as she may not arrive when expected. There seems to be no good reason for leaving a colony queenless three days before introducing the new queen. It doubles the labor and there is no evidence that the reception of the introduced queen is made more certain.

Another indirect method is by the use of what is known as the "push in the comb" cage. This is simply a shallow wire cloth box

with one open side. It is made of a piece of wire mosquito bar or similar wire cloth about five inches square. From each corner is cut a piece half an inch square and the edges are given a right-angled fold resulting in the shallow cage.

To introduce a queen by this method, a comb containing emerging brood with cells of honey within two inches of it is taken indoors. Before a window the mailing cage is opened allowing the queen to crawl up on the window. She is then caught by the wings and placed on the comb and covered with the cage in such a manner that she will have access to empty cells and honey and emerging bees to keep her company. The cage is pressed into the comb firmly enough to prevent its falling off.

Soon the queen will place eggs in the empty cells and the emerging bees will be friendly to her, both of which seem to be favorable for her reception by the colony.

In about three days the cage may be removed by the beekeeper and the queen released if the bees have not burrowed under the edge and in that manner released her. Some beekeepers prefer to bore a hole through the comb into the cage from the opposite side, leaving the particles of comb in the hole for the bees to remove. This insures that the queen shall make her exit among the bees after the disturbance has subsided, and for that reason it is believed to be a good plan.

Balling Queen

Not always does a colony accept an introduced queen, but they may cluster about her in a tight mass making a cluster about 1 1/2 inches or less in diameter. Whether they sting her, smother her or deprive her of food and thus cause her death is not proven, but the queen is often dead when the cluster breaks.

Balling may occur when a colony is opened too soon after a queen has been introduced. This is likely to occur especially where there is no honey flow.

The usual practice when a queen is found balled is to smoke the mass to cause the bees to disperse and again cage the queen, hoping that later the bees will accept the queen. When convenient the cluster may be dropped in water to cause the ball to break up.

There is as yet no absolutely certain method of introducing a queen. A loss of ten per cent is not considered unusual.

DISEASES AND ENEMIES

Brood Diseases

There are three known diseases of the brood of bees, called

American foulbrood, European foulbrood and sacbrood. These cause loss to the beekeeper by causing the death of developing brood, thus reducing the colony in strength so that it becomes unproductive and may fall a prey to wax moths or die from depletion. These diseases also cause loss to the beekeeper by increasing the labor necessary to keep them under control.

American Foulbrood

This disease is caused by *bacillus larvae*, White*, an organism which is harmless except to the baby bees. American foulbrood was so named because it was first seriously studied in America. Death

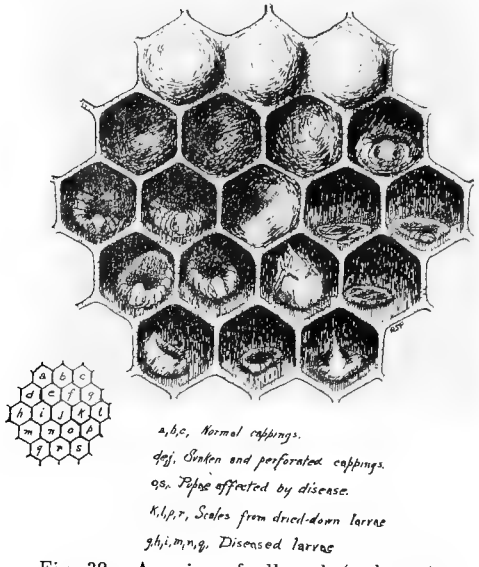

a,b,c, Normal cappings.
d,e,f, Sunken and perforated cappings.
g,n, Pupae affected by disease.
k,l,p,r, Scales from dried-down larvae
g,h,i,m,n,q, Diseased larvae

Fig. 38. American foulbrood (redrawn).

from the attacks of this organism occurs principally after the developing bees have been sealed in the cell. The normal color of healthy larvae is pearly white, but when attacked by this disease the larvae become a light brown, later turning to dark brown. Since death as a rule does not occur until after the larva is sealed, at that time it is lengthwise of the cell with the posterior portion slightly elevated against the cell base. (Fig. 38). Therefore, the remains of larvae dead of this disease are usually on the lower cell wall. This position is best observed by holding an infected comb upright in such a way that the light comes from over the shoulder and looking at the

*White, G. F., 1907. The cause of American Foulbrood. United States Department Agriculture. Bureau Entomology Circular, 94.

lower cell walls. As the larvae decay the cappings become discolored, sunken and perforated by the bees, many cappings being entirely removed by the bees in their effort to clean up. These sunken and perforated cappings are one of the symptoms which first attract the beekeepers' attention. After the death of the larvae the remains dry until there is visible only a scale on the lower cell wall. These scales adhere very tightly to the cell walls and practically cannot be removed by the bees. There is a characteristic odor about a comb containing a considerable number of larvae dead of American foulbrood which has been described as the "glue pot" odor. In some cases this is not very pronounced. At a certain stage in the decay of the dead creature just previous to the dry stage, it is sometimes possible when inserting a small sliver of wood into the decaying mass to withdraw it and have the rotten material stretch out like a thread for as much as three inches. In some cases death does not overtake the developing creature until the pupal stage has been reached and there may be found cases where the pupal tongue will be seen extended at an angle of forty-five degrees across the cell from the lower front towards the upper back part. This latter symptom is said by Doctor Phillips to be conclusive evidence that American foulbrood is present in the colony. Of the other symptoms, color, odor and position, it is believed the latter is most reliable. The dried down larvae adhere tightly to the cell wall, making it impossible for the bees to remove many, if any, of them. A colony of bees is subject to an attack of this disease at any period of the brood-rearing season.

This disease is carried from colony to colony and place to place in infected honey which the bees may rob from an infected colony; from infected honey which may be shipped and the container without washing thrown out where bees can get at it; it may be carried in queen cage candy which has been made with infected honey, or it may be transmitted by contaminated hives, tools and apparatus.

Preventive Measures—There is no evidence to show that American foulbrood attacks one race of honey bees more than another, and we have nothing definite to hope for in preventing the disease from this quarter. It is known that the spores of this disease are carried in honey and that considerable honey on the market is produced in infected apiaries. Therefore, the beekeeper should never feed his bees honey purchased on the open market. Feeding honey is a doubtful practice except where the honey is the beekeeper's own production and he knows positively that it is free of disease germs.

Remedial Measures—Remedial measures in short consist in removing from the infected colony all material which could carry

infection, causing the bees to make a new start. The usual process is to shake or brush (brushing preferred) all the bees from the infected hive into a clean hive equipped with full sheets of foundation, melt up or burn the old combs and disinfect by scorching the hive and frames before again putting them into use. Because the scales contain millions of the spores of this disease, the combs must be destroyed. This treatment gives best results when done just at the beginning of a honey flow. The bees do not always take kindly to this radical change in their household arrangements and may abscond. To prevent this a queen excluder may be placed between the hive body and the bottom board, a queen and drone trap may be fixed at the hive entrance or a piece of queen-excluding zinc may be placed before the entrance to retain the queen.

If there is much healthy brood in the treated combs they may be stacked several stories high over a weak colony and after ten days, when the worth-while brood will have emerged, this colony treated and the combs disposed of by boiling and the wax recovered. The heat necessary to melt combs renders the wax safe for use.

Chantry Method—A modification of this treatment known as the "Chantry" method appears to have considerable to recommend it because the bees are not so greatly demoralized and the queen retainer is not needed.

This consists first of reducing the colony to one story two days before the treatment if it occupies more than one story; second, the bees are brushed into the prepared hive as before, except that it has in the center one empty dry comb, one which the beekeeper plans to discard, leaving this comb for forty-eight hours only. Then it is quickly removed, the bees brushed off and the comb destroyed. The gradual reduction in the size of the hive seems to cause less discontent. The empty comb serves as a place for the deposition of eggs, keeping the queen better satisfied, and in this old comb the bees, when the excitement from brushing has subsided, place the honey which they took up in their honey sacs and which may contain germs of disease. When this comb is quickly removed there is small chance for the bees to recover any of the infected honey. When American foulbrood is found in a colony it should be treated before it is allowed to become a producer of surplus honey.

With so much honey on the market in which there may be germs of this disease, it is not a source of great surprise when it shows itself in new areas, particularly around the larger towns and cities.

The beekeeper may have no surety against infection in this manner, but he is morally if not legally guilty if he does not employ every known measure to rid his bees of infection and prevent its spread as much as lies in his power.

Great care should be used to prevent other bees getting any of the honey from the infected combs, and if there is any possibility of honey dropping from them to the ground during treatment newspapers should be spread to catch any possible drops and the paper burned.

After treatment the hive body, bottom and top should be scorched or in some manner subjected to over 212°F. to free them from infection which may be on them.

No disinfectants known are effective in killing the germ causing American foulbrood.

The frames may be made safe for further use by boiling for half an hour, by dipping in boiling lye water, one can of lye to a washboiler of water, or by subjecting to rather high heat by baking.

One New Jersey beekeeper successfully got the bees out of the infected hive into the clean one by placing the infected colony over the clean hive with nothing between and smoked and brushed the bees down as the combs were removed one by one.

Any honey which may be in the combs may be extracted and put to family use, or it may be diluted with an equal amount of water, boiled for half an hour in a closed vessel and fed to bees.

This should never be fed when it will be used for winter stores, as it will surely cause dysentery and death to the bees.

European Foulbrood

Description—This is a disease of the brood of bees caused by *bacillus pluton* White.* This organism causes death of the larvae in the majority of cases before the time for sealing has arrived. The color of the affected larvae differs much. It may be discolored only by having a yellow spot near the head, or it may be a light brown or a dark brown. The odor when present, which is not always, is distinctive but not easily described. It resembles in a measure the odor of ear wax (cerumen). The position of dead larvae also varies and in truth it may be said that there is practically no possible position in the cell which the dead larvae do not assume. The per cent of larvae affected also varies and may involve a very few cells up to ninety per cent of the larvae. Its progress in the colony is often rapid but may be slow. Thus it will be seen that the symptoms are exceedingly variable. As the writer has had opportunity to study the manifestations of this disease in New Jersey the most dependable symptom is the position of the larval remains (scales) in the cells and the shape of the scales themselves. The scales are exceedingly irregular in form, and their

*White, G. F., 1912. The Cause of European Foulbrood. United States Department Agriculture. Bureau Entomology Circular 157.

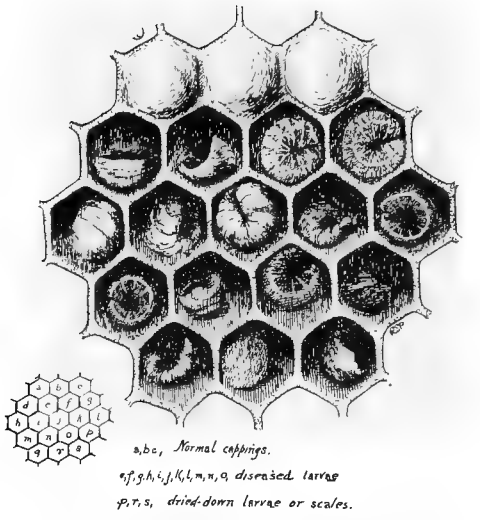


Fig. 39. European foulbrood (redrawn).

position in the cells is almost limitless in variety. (Fig. 39). The scales do not adhere tightly to the cell walls, and the bees remove many of them. If the colony is sufficiently strong in young bees, they will entirely clean out the scales. Bees are more subject to an attack of this disease during the forepart of the brood-rearing season.

The manner in which this disease is transmitted is not well understood. It is believed it is carried in the honey.

It would seem that bees of a good Italian strain, when well cared for so far as food supply and winter protection is concerned, as a rule are able to throw off an attack of European foulbrood or to resist it entirely.

Preventive Measures—Beekeepers have learned from experience that certain bees show a great resistance to *bacillus pluton*. So high is the resistance that in many cases it approaches immunity. This trait is more in evidence in the Italian bees than in blacks or hybrids of these two races. Occasionally there is found a colony of blacks or hybrids which shows this trait to a marked degree, but this is the exception rather than the rule. On the other hand, occasionally a colony of Italians will show a low order of resistance. This also is not common.

It is evident, then, that the beekeeper cannot afford to risk an attack of European foulbrood by keeping anything except good Italians.

Doctor Phillips is authority for the statement that a colony of

bees well wintered, with sufficient insulation and an abundance of good stores, will be much less subject to an attack of this disease.

Remedial Measures—Farmers' Bulletin No. 442* advises the shaking treatment for European foulbrood with the addition of a vigorous Italian queen, and for cases of heavy infection (seventy-five per cent or more) the writer believes this treatment still applies. In aggravated cases there is such an enormous amount of infected material to be cleaned out that it is the writer's belief that it is more economical to take away and render these much infected combs. Then let the bees use their energy in building new combs or in working with uninfected, ready-built combs, always, of course, removing the old queen and giving a young, vigorous Italian.

A method for treatment, known as the Alexander, is giving good results *when handled with care.* There are three factors involved in this treatment, all of which in most cases must be used to obtain satisfactory results. These are (a) a strong colony (b) a period of queenlessness (c) a vigorous Italian queen introduced.

Strength of Colony—Sometimes, although not frequently, the colony is already strong when it is discovered to be infected with European foulbrood. If this should be the case the beekeeper is saved the work of strengthening it.

Strength of colony necessary for a clean-up of European foulbrood, according to Doctor Miller and the Dadants, is at least an amount of brood sufficient to fill five frames of Langstroth dimensions and enough bees to cover seven frames. If infected colonies are not up to this standard of strength two or more should be united until this strength is attained, or a colony may be strengthened by the addition of combs of emerging healthy brood.

Period of Queenlessness—The method as published by Alexander called for a twenty-one-day period of queenlessness. When Doctor Miller tried this plan he misread the directions and gave a ten-day period of queenlessness and *effected a cure.* This led to further experimentation along this line and seems to have resulted in a very flexible rule governing this period. There is evidence to show that bees vary in their ability or disposition to clean out the infected material and that a colony should be left without a queen until they have cleaned out most of the dead matter. It will readily be seen that the per cent of infection and the disposition of the bees are the two factors in the clean-up. The condition of Doctor Miller's colonies should not be overlooked, as they were undoubtedly above the average in strength and vigor.

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*Phillips, E. F., 1913. The Treatment of Bee Diseases. United States Department Agriculture. Farmers' Bulletin, 442.

Introduction of Vigorous Italian Queen of Resistant Stock—Unfortunately bee breeding has not as yet been carried to the place where anyone can safely say his bees are European foulbrood proof. Indeed this time may be far distant. The best, then, that can be done is to secure queens from a reputable dealer unless the beekeeper is so situated that he can get pure matings in his own locality. If the beekeeper can rear the queens for this operation it will prove beneficial if mature queen cells rather than virgins or laying queens be introduced to the colony under treatment. The period of expectancy and preparation when the queen is due to emerge from the cell and until she has had the mating flight appears to stimulate the cleaning-up process. Of course it is necessary to have good Italian stock from which to rear the queens.

A bountiful honey flow will serve to stimulate the clean-up, and a meager one will have a deterrent effect.

Sacbrood

Sacbrood is a disease of the larvae of honey bees which, according to White*, is caused by "a filterable virus." This causes the death of the larva at the stage of its development just after sealing when the larva is extended in the cell. The bees soon remove the cappings from cells containing the dead larva, exposing to the view of the beekeeper the dead larva with head pointed, curled upward away from the lower cell wall, Chinaman shoe fashion, and the forward quarter of the larva darker than the posterior portion. The color of the forward portion is a dirty brown, somewhat mottled. The posterior portion is usually only slightly discolored with brown. If these larvae are burst the contents are found to be watery and somewhat granular.

Aside from the position in the cell the most characteristic symptom of this disorder is the fact that if the head is carefully grasped the larva can be lifted from the cell entire, whereas in American or European foulbrood a like procedure would result in lifting from the cell only that portion of the larva grasped.

Seldom in New Jersey does sacbrood cause any appreciable decrease in strength of the colony attacked. The reason for a discussion of this disorder is that the beekeeper may be able to recognize it and not confound it with foulbrood, either American or European, and needlessly treat the colony.

Remedial Measures—Since the cause of this bee disorder is not known no definite directions for treatment can be given, and the only

*White, G. F., 1913. Sacbrood a Disease of Bees. United States Department Agriculture. Bureau Entomology Bulletin, 169.

suggestion which seems advisable is that a colony much affected be given a vigorous Italian queen.

BROOD DISEASES CONTRASTED

American Foulbrood	*European Foulbrood*	*Sacbrood*
1. Larva dies at advanced stage of its growth, many after sealing.	1. Most of the larvae die before time for sealing.	1. Larva dies after sealing.
2. Color a decided brown.	2. Color gray, yellow and light brown.	2. Color, dirty light brown often mottled, head almost black.
3. Odor distinct but not intense.	3. Odor pronounced, often intense, sometimes almost absent.	3. Odor very slight yeasty.
4. Spreads slowly in hive and apiary.	4. Usually spreads rapidly in hive and apiary. May spread slowly in both.	4. Spreads very slowly over exceedingly small areas.
5. Dead larva on lower cell wall except in colony in the last stages of the disease.	5. Dead larvae in every conceivable position in cell.	5. Dead larva on lower cell wall.
6. Larva decays as one mass and in advanced stage may be ropy.	6. Larva decays as one mass, and has jelly-like consistency and is not markedly ropy.	6. Larval skin remains unbroken and contents are watery.
7. Scales formed by dried-down larvae are on lower cell wall and are removed with difficulty by the beekeeper and not at all by the bees.	7. Irregular scales in every position in cells and not difficult of removal.	7. Scales regular on lower cell wall and do not adhere at all.

ADULT BEE DISEASES

Adult bee diseases are imperfectly understood, and much that has been written on the subject is probably mere conjecture.

Paralysis

There is a disorder of adult bees which is called paralysis or palsy. The manifestation of this disorder is the dead and sick bees massed on the ground in front of the affected colony within a radius of twelve to fifteen inches of the entrance. These are principally old bees, many of which are quite devoid of hairs and give the appearance of having been dipped into oil. The wings are often held at an unnatural angle, and the bees exhibit a trembling motion. Often the abdomens are considerably swollen.

These shaking, hairless bees are often seen on top the frames when an affected colony is opened.

Not often does this disorder cause the death of a colony, but it frequently takes such a toll of the working force that the colony is rendered unproductive.

Without any real foundation for such recommendations, the suggested treatments are requeening, sprinkling powdered sulphur on top the frames and transferring the colony to the stand of a healthy populous one.

The introduction of a more vigorous queen is in itself a good move, and of the three suggested treatments this probably has the most to recommend it.

Crawling Disorder

A disorder of adult bees, because it is in a measure descriptive of the behavior of the affected bees, the writer has chosen to designate the crawling disorder. So far as can be learned this first made its appearance in New Jersey near Matawan, Monmouth County, in 1912. What appeared to be the same trouble had been seen at Huguenot Park, S. I., N. Y. as early as 1906. This disorder continued to spread until in 1918 it could be found from Matawan across Monmouth County to Allentown and to Hamilton Square in Mercer County. What appears to be the same trouble has been observed at Washington in Warren County, Palatine in Salem County, Glassboro in Gloucester County, Moorestown in Burlington County and Lakewood in Ocean County. The bees which are affected by this trouble are for the greater part young adults at about the age when they do the first field work.

The affected bees may be seen crawling in every direction away from the hive, many exhibiting a nervous haste. Many are found clustered together in groups on small objects such as sticks and stones or in depressions in the earth. When disturbed these bees show an indisposition to move, similar to bees benumbed by cold.

This disorder appears suddenly and may be in evidence but a few days and disappear as suddenly as it came. In aggravated cases the colony becomes entirely depopulated, even the queen deserting the hive. This disorder has usually occurred during a period when there was little or no nectar gathering due to dull weather, and when bright sunshiny weather reappeared the trouble often abated.

The only abnormal condition noticed inside the affected colony is the decreased population, the decline in brood-rearing and an excessive amount of stored pollen.

The greater amount of this trouble has been seen where white potato growing is carried on extensively and dusting with arsenicals for the control of insects is common. For this reason beekeepers in the regions affected have believed the trouble is poisoning from

the collections from clover on fields adjacent to the dusted potatoes where the dust floats and settles on the clover. It has also been suggested that bees get the poison from leaves of plants when gathering moisture from them. In support of this theory is the fact that in some samples of affected bees subjected to chemical analysis arsenic was found in sufficient quantity, it is believed, to kill the bees. On the other hand no poison was found in other samples in no way, so far as could be seen, differing from those which showed arsenic.

Remedial Measures—The only suggestion which can be given to a beekeeper whose bees are troubled with this disorder is to move them out of the affected zone.

It has been suggested that this disorder, the Isle of Wight disease and May disease are the same under different names. This, also, is mere conjecture.

Dysentery

This is a trouble which is sometimes experienced by adult bees and is due to their being confined to the hive for a long time by low temperature when the stores contain much material which is indigestible by bees. Under this condition there is a great accumulation in the intestines. The bees normally void this accumulation while on the wing. However, when it becomes great they may be forced to void it in the hive. When this occurs the frames, combs and bees are befouled, and unless the bees shortly get relief in flight they perish.

Preventive Measures—No remedial measures are open to the beekeeper, but he must depend upon the weather for the only help that can be given. He can nevertheless take precautions against this condition. These are (1) if the stores are of doubtful quality he can feed, in the fall after the bees have ceased gathering from natural sources, five or more pounds of sugar made into a syrup. Mix one part of hot water and two parts by weight or measure of sugar; and (2) he can provide an abundance of winter packing and thus slow down consumption and consequently the accumulation of feces.

ENEMIES

Birds

Some birds, prominent in the list of which is the king bird, have been accused of being enemies of bees in that they catch them while on the wing. The few drones or workers which might be so caught would hardly make any appreciable difference to the colony.

If queens were thus caught when on the mating flight serious loss would result, especially in a queen-rearing apiary. The evidence that this occurs in New Jersey is not clear.

Wax Moth

The wax moth is a greyish insect (Fig. 40) measuring about 5/8 inches long with a wing spread of 1 1/4 inches, which deposits its eggs on unprotected bee comb, and when the larva (Fig. 41) emerges

Fig. 40. Wax moth (original).

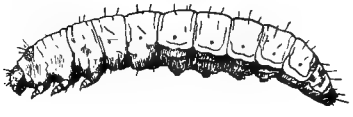

Fig. 41. Wax moth larva, enlarged (original).

from the egg it feeds on the pollen and cocoons of the combs.

As the larva develops in size it spins a silken gallery through the combs which serves as a protection against attacks of the bees. When the larva has attained its growth it spins a cocoon, and in due time the adult moth emerges.

This insect causes loss to the beekeeper by damaging stored combs either with or without honey and also combs in colonies too weak to protect them properly.

The black and hybrid bees do not show as great resistance to this insect as do the Italians. If only Italian bees are kept and the colonies are always strong, no damage will come to the colony from this source.

Should a colony become weakened and be attacked by the wax moth it should either be strengthened, or all combs not covered by bees removed from the hive and fumigated with carbon bisulphide or burning sulphur.

In using either of these fumigants it must be remembered that the fumes of carbon bisulphide descend and the fumes of burning sulphur arise. Therefore, when carbon bisulphide is used it is put on top the combs to be fumigated; sulphur is put below.

Toads

Toads are sometimes mentioned as bee enemies. It is not likely that if they do eat bees enough are taken to cause appreciable loss. Toads are beneficial in keeping down harmful insects and should not be killed. If desired they may be kept away from the hive by wire cloth with mesh of suitable size.

Skunks

Considerable damage may be done in the apiary by skunks, both by the untimely disturbance of the bees, particularly in winter, and by annoying them in summer, making them more difficult to handle by the beekeeper.

The skunks apparently paw at the hive entrance, induce the bees to come out and then eat them. The number of bees eaten would not in itself constitute a serious damage, but the disturbance in winter dissipates the bees' energy. This renders the colony less likely to survive the winter season in good condition.

Sometimes in summer the bees are so annoyed by skunks that whenever the beekeeper goes to the apiary he finds his work more difficult because of cross bees.

The remedy is either to fence the apiary skunk-tight or to kill the skunks.

Snakes

These are also beneficial animals, except the venomous kinds, and if harm to bees is anticipated through their visits they also may be excluded by wire netting.

Mice

When the bees are inactive during the colder period of the year, mice will enter the bee hives, if possible, make nests in the combs and feed on the bees. This occurs only during the inactive period. Damage is done a colony both in the mutilation of the combs and the dissipation of the bees' energy due to the disturbance. The bees which are eaten constitute only a minor part of the damage.

The remedy is to reduce the entrance to the hive to such size that mice cannot enter. If the entrance is no more than a quarter inch high mice will be debarred.

FEEDING BEES

Although normally bees gather all the food they need, occasion may arise when this is not possible and the beekeeper to properly

care for the bees, must supply the deficiency. It is believed that there is no place in New Jersey where there is a shortage of pollen sufficient to make it advisable to feed the bees a substitute if there were such a thing. Various substances have been suggested as pollen substitutes, but those who have investigated the subject believe nothing is an advantage and many so-called pollen substitutes may be harmful to the bees.

When the bees are short of stores the best way to feed is to give them combs of disease-free honey. Very often, however, this is impractical for one reason or another. It is possible to use sugar syrup as a substitute, and there is no tangible evidence to show that harm has ever come through this practice. Granulated sugar only should be used for feeding.

For feeding in the active season a syrup made of two parts water to one part sugar by measure may be used, or the syrup may be even heavier—equal parts of sugar and water. For feeding late in the season when it is desired to supplement the amount the bees have been able to store for winter the proportions should be two of sugar and one of water, or even 2 1/2 parts sugar. It will be necessary to use hot water to dissolve this proportion of sugar.

Feeder

Seldom if ever is it desirable to practice what is called open air feeding when the material to be fed is placed where all the bees in the apiary may help themselves.

Individual feeding is best and calls for individual feeders. A variety of styles of these are listed by the dealers in beekeepers' supplies. It is the opinion of the writer that what is known as the friction top tin can will serve the purpose of a bee feeder for all conditions better than any other type. This can is such as that in which some paints and cooking fats are sold and has a depressed lid. To adapt the can to bee feeding the lid should be perforated with holes 1/16 inch or less in diameter and about 3/8 inch apart.

To use this feeder fill it with the syrup, press the lid firmly in place and invert it directly on top the frames over the bees to be fed. To provide room for the can an empty hive body is used as a second story, and if the weather is cool a cloth may be spread over the can and top of the frames to help retain the heat within the cluster. Care must be used that the can is nearly level or the feed may leak out.

This places the feed close to the bees and they can take it without breaking cluster and only the needy colony can get the feed. If a considerable amount of feed is needed by a colony a number of cans may be used. Fall feeding should be done as rapidly as

possible, or untimely broodrearing may be started. As much as two gallons of heavy syrup has been taken down by a strong colony in less than 24 hours. For late feeding the feed may be given as warm as the finger can be borne in it.

ROBBING

Honey bees have no pity for a weak neighbor but will, when given the opportunity, rob such a weak colony of all its stores. Prevention of robbing is much better than any cure, and when a beekeeper has had a robbing fracas on his hands he usually is careful that no fault of his causes a second such affair. When robbing is at its height the bees become furious and will sting almost anything in the neighborhood, animate or inanimate.

When a colony is robbed no smoke should be used on it, but the entrance should be contracted to a size that will permit but one bee at a time to pass and grass or hay placed lightly over the entrance. It is better yet if the hay is liberally sprinkled with water.

If a colony has been so badly robbed that saving it seems impracticable, it may be best to let the robbers complete their work and become satisfied that nothing more can be had from that source. Sometimes the robbed colony will desert its home and go with the robbers.

It should be borne in mind that robbing always is extremely undesirable, and especially so when disease is in the apiary or neighborhood.

SMOKER FUEL

Perhaps every inflammable material has at one time or another been used as fuel for the bee smoker. Nevertheless some materials are decidedly better for this purpose than are others. Tobacco is sometimes recommended for vicious colonies, but it is much better to discard the vicious stock, and evidence is lacking to show that tobacco smoke gives better control than smoke of burning wood.

Because it fires easily and burns freely, rotten wood of any variety gives excellent results. Crushed corn-cobs make a good smoke when once well fired but cause the smoker to become clogged with creosote. Burlap which is rotten enough to be easily torn gives a good smoke. New burlap is not easily fired. Wood chips are also excellent. Greasy waste has been suggested for use in the smoker. When oily enough to light readily it often refuses to continue burning freely; when less greasy it does not fire easily. There is some evidence to show that the fumes from greasy waste have an effect upon the bees opposite the desired one and they become infuriated.

SPRING DWINDLING

Another trouble sometimes met by the beekeeper is called spring dwindling. The colony at that time in the late spring when it normally should be rapidly increasing in strength declines in numerical force. There is a mortality of the adult bees greater than is made up by the emerging bees, and the colony may be reduced in strength to such a degree that it becomes unprofitable if it does not succumb entirely.

This is believed to be evidence of poor wintering. The adult bees, because of the intense activity in raising the cluster temperature, become exhausted of vitality unduly early in the season and die before young bees can be reared to take their places. The remedy, better wintering practice, is obvious.

TRANSFERRING BEES

Unfortunately there are still a few bees in box hives in New Jersey, and occasionally there is a colony with immovable combs because no foundation has been used in the frames. It is highly desirable that all bees be on movable combs in order that the manipulations necessary in modern beekeeping may be readily accomplished and that bee diseases be detected and controlled.

The method of transferring the movable comb hives known as the Heddon short method has much to recommend it, the chief advantage being the fact that there is less likelihood of the person with small experience meeting failure. Transferring by this method is best accomplished at fruit-blossoming time. No extra apparatus is needed in transferring from a movable frame hive with crooked combs, and in transferring from a box there is needed only another box of the same width and length as the open end of the box hive and about twelve inches deep.

First, vigorously smoke the box hive to be operated on, then turn it bottom up and place the prepared box on it with the two open ends together. Should there be cracks or holes where bees may escape they should be stopped. Then pound vigorously on the sides of the old hive for about ten minutes. The greater part of the bees and the queen will run up and cluster in the upper box. They should then be dumped in front of a hive prepared for a swarm, placed where the box hive stood and the box hive placed ten feet away from its former location.

If the colony to be transferred is on crooked combs in a regular size hive, the prepared hive may be placed as the second story and the bees drummed up into it. The top story should then be put on

a bottom board and placed where the old colony stood, and the old colony moved to a stand ten feet away.

A new queen will be reared in the old hive, and the hatching bees will make a fair-sized colony if the old colony was populous.

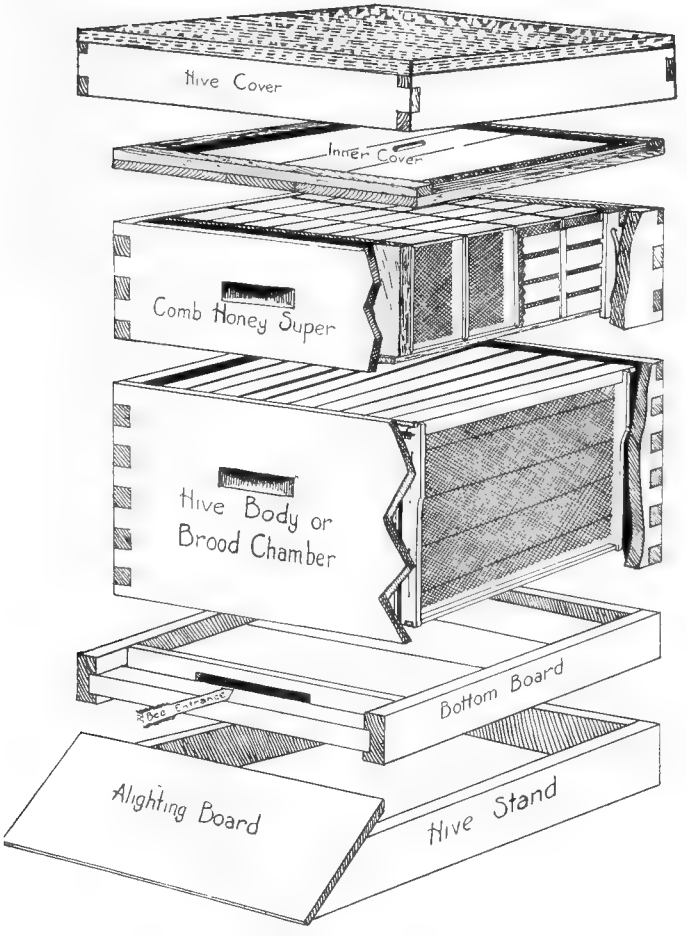

Fig. 42. Showing the several parts of a modern beehive and their relation one to the other (Root).

At the end of three weeks the operation should be repeated on the old colony, and this second drive hived as a separate swarm or it may be united with the first drive. The combs can then be cut from the old hive and made into wax.

"TANGING"

Beating on pans or ringing bells—"tanging" as it is called—to cause a flying swarm to settle has not been proven to have any effect on the bees. Spraying with water or throwing sand among them sometimes causes them to alight.

SNOW-COVERED HIVES

There is no evidence to show that harm has come to bees in New Jersey due to being covered with snow. In fact it seems to have a beneficial effect. Should the entrance be covered with snow no harm will result. If a colony is strong enough to need more air than comes through the snow they will raise the temperature enough to melt the snow in front of the entrance. If not strong enough to need more air they are all right even with the entrance covered. Through mistaken kindness some beekeepers remove the snow from the entrances of hives. This does the bees no good and actually results in harm, due to the disturbance.

These statements apply to colonies of bees wintered out-of-doors without extra protection. Although this is a rather common practice it is a very poor one. If the hive is covered with an outer case or other winter protection there is still less reason for disturbing the snow-covered entrances.

BEE DISEASE CONTROL LAWS

In order that better control of bees diseases might be brought about, in 1911 the following bill was enacted.

CHAPTER 60.

LAWS OF 1911.

An act to supplement an act entitled "An act to prevent the introduction into and the spread of injurious insects in New Jersey, to provide a method for compelling their destruction, to create the office of State Entomologist, to authorize inspection of nurseries and to provide for certificates of inspection," approved April fourteenth, one thousand nine hundred and three; to provide for the inspection of apiaries and for the suppression of contagious or infectious diseases among bees.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*:

1. It shall be unlawful for any person, firm or corporation to have or keep in his or their possession or in any apiary, any colony of bees infected by the diseases known as American foulbrood or European foulbrood or by any other disease which is contagious or infectious in its nature and injurious to honey bees in their egg, larval, pupal or adult stages, and any person, firm or corporation so having in his or their keeping or in his or their possession any colony of bees so infected, after notice of the existence of such disease given as hereinafter provided, shall become and be subject to a penalty of twenty-five dollars, to be collected as hereinafter provided.

2. It shall be the duty of any person, firm or corporation in the State of New Jersey who is engaged in the rearing of queen-bees for sale, to have his or their apiary inspected at least twice during each summer, and it shall be unlawful to ship from such queen-rearing apiaries any package or parcel containing queen-bees without having attached to it a certificate from the State Entomologist, giving the date of the last inspection, and containing the statement that the apiary in which such queen-bees were reared was, at the time of such inspection, free from American or European foulbrood, or other discoverable contagious or infectious disease. Any person violating the provisions of this section shall be liable to a penalty of fifty dollars, recoverable as hereinafter provided.

3. It shall be the duty of the State Entomologist, designated as provided in the act to which this is a supplement, by himself or by a deputy appointed as provided in said act, to investigate, or cause to be investigated, all apiaries or other places where bees are kept or raised in New Jersey, and to study and investigate, or cause to be studied and investigated, outbreaks of bee disease and other conditions unfavorable to the development of bees within the State. It shall also be the duty of said entomologist to investigate all complaints of the existence of disease of any kind in apiaries or other places where bees are kept, and to inspect or cause to be inspected at least twice each season, when requested by the owner, all apiaries where queen-bees are reared for sale. It shall further be the duty of said State Entomologist, whenever he finds any apiary where queen-bees are raised free from foulbrood or other discoverable infectious or contagious disease, to furnish the owner of such apiary with a certificate stating that fact, and such certificate shall state the date beyond which it will not be effective.

4. Whenever in the course of the inspections or investigations made or carried on as provided in this act by the State Entomologist or under his direction, said State Entomologist shall become aware of the existence of American or European foulbrood or other infec-

tious or contagious disease in any apiary or colony of bees, it shall be his duty to notify forthwith the owner or owners or manager of such infested or diseased apiary or colony, of the character of the infection and of the means to be taken to treat the same for the eradication of such disease. Said notice and order for treatment shall be in writing, and the directions for treatment may be written or printed, and may consist of a bulletin or other publication of the New Jersey State College Experiment Station. Said notice and order for treatment shall also specify the time within which the prescribed treatment must be made, which shall not be less than eight days after service of the notice or order upon the owner, owners or manager of the apiary or colony. And in case of doubt, where the presence of disease is suspected but cannot be definitely determined because of the character of the hives used, said State Entomologist may, in his discretion, order any owner of bees in box hives without movable frames, to transfer such bees to movable-frame hives to facilitate inspection and supervision. It shall thereupon be the duty of the owner, owners or manager upon whom such a notice and order is served, to comply with it in all respects within the time limited in said notice and order, and in case of a failure so to comply, such owner, owners or manager shall be liable to a penalty of twenty-five dollars, recoverable as hereinafter specified.

5. It shall be unlawful for any owner or other person having diseased bees or their larvae, or infested hives or combs, or other appliances or utensils for keeping bees, to expose, sell, barter or give away or allow the same to be moved, until after treatment as prescribed by the State Entomologist, and it shall be unlawful to expose, sell, barter or give away such infested bees, larvae, hives or combs or other appliances after treatment, until such materials are declared safe and permission is given by the State Entomologist or his deputy. Any person offending against the requirements and provisions of this section shall be liable to a penalty of fifty dollars.

6. In case the State Entomologist or his deputy shall find any apiary or colony of bees, in his opinion, so badly infested by American or European foulbrood or other infectious or contagious disease that he shall deem it necessary to order the destruction of same or all of the hives, combs, bees, larvae or other material as part of the treatment, and the owner, owners or manager of such infested apiary or colony shall dispute the diagnosis made by the State Entomologist or his deputy, or the necessity for the destruction of the hives, combs, bees, larvae or other material, it shall be the privilege of such owner, owners or manager to appeal within three days after the service of the notice and order upon him or them, to the committee of appeal provided for in section twelve of the act to which this

is a supplement, and the proceedings of such appeal shall be in all respects as provided in said section. Said committee of appeal shall have the same power to reverse, modify or confirm the order of the State Entomologist made under this act, that is conferred upon them in the act to which this is a supplement.

7. Any person who offends against the provisions of this act and becomes liable to the penalties prescribed in any of its sections shall be prosecuted as prescribed in section fifteen of the act to which this is a supplement, as amended by chapter forty-seven of the laws of one thousand nine hundred and four, approved March twenty-second, one thousand nine hundred and four, and if the order of the State Entomologist commanded the destruction of any bees, larvae, hives, combs, or other utensils or material used in keeping bees, the judgment of the court imposing the fine shall include also an order to the officer enforcing its judgment to seize and destroy the specified colonies of bees, larvae, hives or combs or other utensils or material used in keeping bees, in accordance with said order, which the said officer shall thereupon be fully authorized to do.

8. For the purpose of making the investigations and inspections specified in this act and to enforce the provisions of the same, the State Entomologist or his deputy shall have free entry upon or into any apiaries or premises where bees are kept, or infected hives or combs are stored, and any interference with or obstruction made to the entomologist or his deputy while engaged in the performance of the duties herein imposed shall subject the offender to punishment as a disorderly person under the general laws of the State, upon a charge made against him by the officer interfered with.

9. The sum of two thousand dollars annually is hereby appropriated to the State Board of Agriculture for the purposes of this supplementary act; *provided*, that no payment shall be made pursuant to this supplementary act until the amount thereof shall have been included in the annual appropriation bill.

10. This act shall take effect immediately.

Approved March 28, 1911.

A careful reading of this measure will show that there is ample provision made for legal steps against the person who does not show a reasonable disposition to control any contagious bee disease which may be in his apiary. It also throws a safeguard around shipped queen bees to prevent disease being carried in the queen mailing cage. It also provides that a due process of law shall be followed in dealing with bee owners likely to become a menace in the spread of bee disease, rather than giving the Bee Inspector unlimited power to destroy as he might see fit or feel inclined to do. We believe

this act gives ample power to control bee diseases and assures proper respect for property rights as well as, if not better than, similar acts for other states.

Believing sufficient restrictions were not provided for incoming bees and apiary material capable of carrying disease, in 1915 a bill was enacted to take care of such incoming bees and material in a way which will provide protection and insure justice to all concerned. This act is known as Chapter 104, Laws of 1915, and follows in full.

CHAPTER 104.

LAWS OF 1915.

A FURTHER SUPPLEMENT to an act entitled "An act to supplement an act entitled 'An act to prevent the introduction into and the spread of injurious insects in New Jersey, to provide a method for compelling their destruction, to create the office of State Entomologist, to authorize inspection of nurseries and to provide for certificates of inspection,' approved April fourteenth, one thousand nine hundred and three; to provide for the inspection of apiaries and for the suppression of contagious or infectious diseases among bees," approved March twenty-eighth, one thousand nine hundred and eleven.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*:

1. No colony or nucleus of bees or used apiary supplies coming from a state or country having apiary inspection service shall be accepted for transportation to points within the State of New Jersey by any person or common carrier unless accompanied by a valid certificate of inspection, stating that such colony or nucleus of bees or used apiary supplies are free from infectious or contagious bee diseases. Any colony or nucleus of bees or used apiary supplies coming into the State from a state or country having no apiary inspection service shall be immediately reported by the consignee and by the common carrier or person delivering same in this State, giving name and address of consignee, to the State Entomologist, who shall cause said shipment to be inspected at such time as shall be expedient; *provided, however*, that nothing in this section shall be construed to apply to the delivery of queen bees when not accompanied by brood or comb, or bees shipped in wire cages when not accompanied with brood or comb. Any person offending against the requirements or provisions of this act shall be liable to a penalty of twenty-five dollars for each offense, to be recovered in action of

debt, in the name of the State Board of Agriculture, said penalty, when recovered, to be paid into the treasury of this State, for the use of the State.

2. All acts and parts of acts inconsistent herewith be and the same are hereby repealed, and this act shall take effect immediately.

Approved March 30th, 1915.

WINTER FEEDING

It is doubtful if any directions for winter feeding are advisable. Already too many bee owners gamble on the weather and bet a good colony of bees in the fall with meagre stores against an abundant and early supply of nectar. If beekeepers in general would act on the principle that it is practically impossible to have too much stores in the hives in the fall after the first killing frost it would make a tremendous increase in the crops of honey harvested. Many a good nectar-producing location yields the beekeeper a small crop because the bees have been obliged to use stores sparingly, due to a limited supply in sight. When the honey harvest arrives, instead of a booming colony of vigorous bees, too often there is but little more than a strong nucleus which increases *on* the honey flow instead of being a full-gathering colony *for* the honey flow.

However, this page may come into the hands of a bee owner who through no fault of his may have colonies of bees with insufficient winter stores too late to feed syrup. There are two feeds which may be given such colonies, one of which is cut loaf sugar placed on top the frames and well covered with blankets, and the other is a candy made by boiling equal amounts of granulated sugar and water until it makes a brittle candy. This is made into cakes one-quarter inch thick and placed on top the frames under the hive cover. Great care must be used to avoid scorching this candy, because if scorched it will cause dysentery and death to the bees.

OWNERSHIP OF ESCAPED SWARMS

If a swarm escapes from the beekeeper, so long as he can keep it in sight he can claim it. If, however, it gets out of his sight anyone who finds the swarm can claim it. Should the swarm alight on a neighbor's property, the owner cannot legally recover the swarm except by permission of the owner of the property.

BEE TREES

There is a common notion that the bees in a tree are the property of the finder, and he may cut the tree to get the bees and honey which may be in it. The truth is the bees belong to the owner of the land

on which the tree stands, and no one has a legal right to cut the tree or take the bees from it unless permission be secured from the owner.

UNITING COLONIES

It sometimes occurs that colonies will be so reduced in strength that uniting two or more is necessary to get together the necessary working force to accomplish the desired object. Except under certain favorable conditions when two colonies of bees are put together they show a decided antagonism one toward the other, a fight ensues and so many bees are killed that no increase of strength of colony is had.

Various plans may be used for having the two colonies unite peaceably, but the one which will give good results under all conditions is known as the newspaper plan. The hive bodies containing the two colonies are placed one above the other when the bees are not flying, with only one sheet of newspaper between. The bees remove the paper and peaceably become one family.

It is best, if one colony is weaker or is queenless, that it be moved to the stronger or queenright one to avoid loss by the bees returning to the old location. After the bees in the moved colony make their way through the newspaper and through the lower colony to the outside, they accept the new location.

WINTERING BEES

At one time when the beekeeper experienced a loss of colonies of bees in winter it was thought to be "bad luck."

The work of Phillips and Demuth* has served to show why bees did or did not survive the winter in good condition, and it is clearly seen that colony loss in winter is due to bad management or no management, either of which will produce practically the same result.

Some of the more prominent causes for winter loss are a failing queen, queenlessness, small colonies, colonies with too small a proportion of young bees, colonies weakened by disease, poor stores and insufficient insulation and inadequate windbreak. (Fig. 43). It is obvious that giving proper attention to these conditions involves nothing difficult nor complicated, and they are all under the beekeeper's control.

If each year a good Italian queen is given to each colony sometime between July 1 and August 10 it is improbable that any trouble from a failing queen will be experienced and queenlessness will also be avoided.

*Phillips, E. F. & Demuth, George S. The Preparation of Bees for Outdoor Wintering. United States Department Agriculture. Farmers' Bulletin, 1012.

Late and excessive swarming or unwise division of colonies may result in small colonies for winter. Swarming can be and should be controlled, and no divisions of colonies should be made subsequent to six weeks before the time the first frost may be expected.

A colony headed by a young queen in July or early August will continue breeding late in the fall provided sufficient stores are in the hive, insuring young bees for winter.

Fig. 43. Unfortunately, many apiaries are obliged to pass through the winter with no more protection than is given this New Jersey apiary.

Colonies which have been weakened by disease should be united until a sufficient number of bees are in one colony to winter well.

A good windbreak is a large factor in the successful wintering of a colony of bees. To keep the temperature of the cluster up to a point at which the queen will surely be protected, the bees, when the temperature of the air surrounding the cluster drops to 57°F., or below, generate heat by muscular activity. Everyone can appreciate the increased rapidity with which this heat is carried off when the hives are not protected from the cold winds.

A solid board fence is not considered as desirable a windbreak as one with many small cracks. When the fence is tight the wind whirls over the top and a return current is set up which blows directly on the row of hives near the fence. An artificial windbreak should be provided if a natural one cannot be had. In some cases the apiary is surrounded by coarse mesh woven wire fencing in

Fig. 44. A New Jersey apiary provided with winter cases, which give ample protection against low temperatures.

which corn stalks are woven. This answers fairly well. It is obvious that a natural windbreak when it can be had is superior to an artificial one. A bluff, the edge of a wood or a row of evergreens are excellent and are self-maintaining. (Fig. 44). Some beekeepers stack corn stalks around the hive for winter. This is far better than no winter protection. So much depends upon the bees having a comfortable winter location that any pains to secure the ideal site will be well repaid.

It has been shown by Phillips and Demuth in their work previously referred to that the quality of the winter stores has much bearing on the way a colony will pass the winter. When the stores are of such quality that there is a large proportion of indigestible matter in them, there is a corresponding accumulation of feces in the bees which causes them to be uneasy, and this uneasiness and activity causes them to consume more of the stores resulting in increased activity. There are localities in New Jersey where the winter stores are usually from some source, principally golden rod, which contains a large percentage of waste matter. In such localities it is good practice to feed each colony after all gathering has ceased five pounds of sugar syrup, made of two parts sugar to one of water. This will be stored near the cluster, where it will be used during the coldest part of the year, and as it is practically all digestible the accumulation of feces will be very small.

Bees do not hibernate. There is a much reduced activity during the winter season, but the cluster temperature of a colony of broodless bees does not go below 57°F. no matter how low the outdoor temperature may be. The only way the bees have of maintaining this temperature is by muscular activity. It is readily seen that to maintain the temperature when the outdoor temperature is low the bees must use considerable muscular activity. To maintain this activity the bees must consume food. This activity not only causes the bees to consume more food, but it uses up their energy so that they are largely worn out when spring arrives and are not able to do efficient work.

To provide that the bees shall come to the spring work with energy unimpaired their winter activities should be slowed down to the lowest possible point. This is accomplished by giving abundant insulation to the colony. The studies of Phillips & Demuth have shown that bees in New Jersey need four inches of packing beneath the hive, six inches on the sides and eight or more inches on top.

The insulating material used will depend largely upon what the beekeeper can conveniently get locally, bearing in mind that the finer materials have a higher insulating value than the coarser ones. Leaves and chaff are good insulators and one or the other is within the reach of every beekeeper. Planer shavings and dry sawdust are also good but present difficulties in keeping them in the proper place. Hay, straw and like coarse long material, are not good for this purpose.

The manner of holding the packing material in place is also largely a matter of individual preference or convenience. Some good beekeepers make a substantial case of 7/8 material large enough to house four colonies placed back to back and allow sufficient room

for packing material. This has the advantage of permanency, and when four colonies are packed in one case the cost of packing each colony is less than it would be if they were cased singly. Some use a rather temporary affair of slats and slaters felt. The essential is that sufficient packing shall be used and that it shall be applied early enough and left in place late enough in the spring. Bear in mind that it is not possible to put on too much packing and no harm can come through excessive packing.

The packing should be applied immediately after the first killing frost in the fall and left in place until the last killing frost in the spring.

PERIODICALS AND PUBLICATIONS

In all probability there has been no change in the response of bees to their environment in the last thousand years, but the manner of guiding their activities to man's profit has and is still undergoing changes. For this reason a beekeeper needs to keep abreast of the changes by making use of the current literature on the subject.

There are two excellent beekeepers' journals: "The American Bee Journal" published monthly at Hamilton, Illinois, and "Gleanings in Bee Culture" also issued monthly, from Medina, Ohio.

Two old bee books, because they so thoroughly discussed bees, have been reprinted and can be had at beekeepers' supply stores. They are "Langstroth on the Hive and Honey Bee" and "Mysteries of Beekeeping Explained," by Quimby. There are a number of good modern works on beekeeping. One of the best for the beginner is Dadant's "First Lessons in Beekeeping." There are also "Beekeeping," Phillips; "Fifty Years Among the Bees," Miller; "A B C & X Y Z of Beekeeping," Root; "Advanced Bee Culture," Hutchinson, and "Langstroth on the Hive and Honey Bee" revised by Dadant.

The United States Department of Agriculture has published bulletins on beekeeping which should be thoroughly studied by every beekeeper who wishes to get the most from his bees, either of pleasure or profit. These can be had by addressing a request to your Congressman at Washington, D. C., and are as follows:

Farmers' Bulletin 447 "Bees."
Farmers' Bulletin 1039 "Commercial Comb Honey Production."
Farmers' Bulletin 695 "The Outdoor Wintering of Bees."
Farmers' Bulletin 1012 "The Preparation of Bees for Outdoor Wintering."
Farmers' Bulletin 975 "The Control of European Foulbrood."
Farmers' Bulletin 1084 "The Control of American Foulbrood."
Farmers' Bulletin 1198 "Swarm Control."
Farmers' Bulletin 1215 "Beekeeping in the Clover Region."

NEW JERSEY BEEKEEPERS' ASSOCIATION

This association has for its object the advancement of the beekeeping industry in New Jersey. Its activities are social and educational, and it is managed by the Executive Committee consisting of president, three vice-presidents and the secretary-treasurer.

It holds an Annual Convention at Trenton during Agricultural Week. At this time at least one speaker on the program is of national repute.

From four to six summer demonstration meetings are held in various parts of the state. At these meetings demonstrations are given of seasonable manipulations of bees. These have proven very popular and profitable.

By arrangements with beekeepers' supply houses liberal discounts are allowed members on purchases of beekeeping apparatus.

The dues at present are $1.00 per year, and the secretary-treasurer is Elmer G. Carr, Pennington, N. J.

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